ERS | *handbook*

Self-Assessment in Respiratory Medicine

2nd Edition

261 questions and comments

Editors
Konrad E. Bloch
with Thomas Brack and
Anita K. Simonds

HERMES
Harmonised Education in Respiratory Medicine for European Specialists

ERS handbook

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Introduction

In recognition of the increasing demand for education and revalidation in respiratory medicine, the European Respiratory Society (ERS) has initiated the Harmonised Education in Respiratory Medicine for European Specialists (HERMES) project. The aim is to promote the highest possible standards of practice in the specialty and to improve harmonisation of training across European countries. The HERMES project has been implemented by ERS Education through a task force coordinating inputs from representatives of more than 52 countries. After describing the knowledge and skills a European Respiratory Specialist should have (see the index to this book)[1] and delineating requirements for the core training curriculum[2,3], the further phases of the project include assessments and accreditation of training centres[4,5].

The European Examination in Adult Respiratory Medicine is one of the assessments developed within the HERMES project[4,5]. It is a knowledge-based test evaluating topics outlined in the European syllabus. The examination consists of 90 multiple-choice questions (MCQs) to be solved within a 3-h examination session. Practising respiratory specialists holding a national accreditation and aiming to receive a European Diploma are eligible to take the examination. An increasing number of trainees undergoing specialist education, as well as postgraduates who wish to evaluate their knowledge, have now taken the examination. All participants receive a detailed analysis of their performance in different areas of the field, but the Diploma is reserved for nationally accredited practising specialists in respiratory medicine.

The MCQs selected for the HERMES examination are created by a panel of authors from various countries and settings, *i.e.* from academic centres, community hospitals and specialist practice. The authors undergo special training in order to produce valid questions. The HERMES examination committee evaluates each new question during workshops and selects those meeting high standards in terms of clinical relevance, unambiguous scientific accuracy and formal aspects. Only questions passing this evaluation are subsequently incorporated into examinations. Questions are further assessed for their difficulty, selectivity and formal suitability. The pass/fail limit of each year's HERMES examination is set according to predefined rules. They incorporate difficulty scores given by committee members for each question reflecting the likelihood of a minimally qualified examinee answering any particular question correctly (Angoff method); a calibration is also performed by comparison of performance in a set of previously used questions (Rasch equating). Thus, rather than targeting any particular pass rate, the pass limit is set at a level that assures that successful candidates demonstrate a high level of knowledge.

In response to requests from candidates preparing for the HERMES examination as well as from practising respiratory physicians, the ERS Education Council has prepared this handbook. It is a collection of MCQs with answers and comments intended to be a self-assessment companion to the ERS Handbook of Respiratory Medicine[5,6], which contains a systematic discussion of topics relevant for the specialist in adult respiratory medicine. We are fully aware that many respiratory professionals at all levels from senior specialists to junior trainees wish to test their knowledge personally without necessarily embarking on the HERMES examination. The MCQ handbook meets that need in a constructive didactic way. The broad range of topics is selected from the syllabus and the relative representation reflects the weights attributed by the examination committee to the different topics,

according to clinical relevance and importance in specialist education as listed in the 'blueprint' (see appendix).

The current, second edition of the ERS handbook Self-Assessment in Respiratory Medicine contains a completely revised and considerably expanded selection of questions that have been prepared by experienced authors and have undergone a rigorous evaluation according to the principles outlined above. The majority of questions are introduced by a case vignette describing a clinical problem to be solved. The purpose is not merely to test the knowledge of facts (which could be looked up in a text book or in the Internet) but rather to evaluate the ability of a candidate to apply knowledge and critically weigh different options in a clinical context. Accordingly, the choice of answers often contains more than one reasonable alternative, from which the candidate has to select the most appropriate one. As a welcome change, other, short questions without vignette are interspersed to test specific knowledge in selected areas. In the comments to each question, evidence in favour and against the various answers is discussed and literature references are provided for further reading.

We hope that all readers of this handbook will enjoy solving the problems presented in the case vignettes and questions, and benefit from assessing and refreshing their knowledge in respiratory medicine.

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How to use this book

This handbook may be used in several ways: for self-assessment; to identify areas of strengths and weaknesses as a guide for further studies; and to refresh and update your knowledge in respiratory medicine. Those who wish to experience how it feels to undergo the HERMES examination may set themselves the challenge of solving 90 of the multiple-choice questions (MCQs) collected in this book within 3 h. The answers should be recorded on a separate sheet of paper without looking up the comments on the back of each question page. Another way of using the book is to solve the MCQs step by step, reading the comments at your convenience. The literature references listed with the comments on the reverse of each MCQ allow further reading to obtain more in-depth information. Still another approach is to use the index to locate and solve MCQs according to a particular syllabus topic of interest in order to test and consolidate knowledge in a specific area.

The MCQs in this handbook are presented according to two different formats: in the single-choice MCQ, the reader is asked to select the only correct answer, or the most appropriate answer, from five options (alternatively, in negatively formulated questions, the only exception or incorrect statement, or the least appropriate of five answers has to be selected). In the HERMES examination, a correct answer to this type of MCQ is awarded 1 point. If more than one answer is marked on the answer sheet, 0 points are given. In the second format of MCQ, four answers or statements are listed and the reader must decide whether each one is correct (true) or incorrect (false). In the HERMES examination, four correct true/false decisions are awarded with 1 point, three correct true/false decisions are awarded with 0.5 points and fewer than three with 0 points.

List of abbreviations

AHI	apnoea–hypopnoea index
BMI	body mass index
COPD	chronic obstructive pulmonary disease
CPAP	continuous positive airway pressure
CT	computed tomography
ECG	electrocardiography
FEV_1	forced expiratory volume in 1 s
FVC	forced vital capacity
HRCT	high-resolution computed tomography
Hb	haemoglobin
K_{CO}	transfer coefficient of the lung for carbon monoxide
MRI	magnetic resonance imaging
NIV	noninvasive ventilation
OSA(S)	obstructive sleep apnoea (syndrome)
P_{aCO_2}	arterial carbon dioxide tension
P_{aO_2}	arterial oxygen tension
P_{tcCO_2}	transcutaneous carbon dioxide tension
S_{aO_2}	arterial oxygen saturation
S_{pO_2}	arterial oxygen saturation measured by pulse oximetry
TLC	total lung capacity
T_{LCO}	transfer factor of the lung for carbon monoxide
V'_E	minute ventilation

Question 1

A 36-year-old immunocompetent male patient was admitted to the hospital with prolonged recurrent fever, cough, anorexia and weight loss. Admission investigations revealed anaemia, while renal and liver function were within normal limits. A chest radiograph showed patchy infiltrates and cavitation in the right upper lobe. Microbiological and molecular tests in sputum were positive for *Mycobacterium tuberculosis* and treatment with isoniazid, rifampicin, ethambutol and pyrazinamide has been started. A few days later, the anti-tuberculosis drug susceptibility test shows isoniazid resistance. Which is the right treatment option for this patient?

a. Isoniazid, rifampicin, ethambutol and pyrazinamide for 6 months
b. Rifampicin, ethambutol and pyrazinamide for 6 months
c. Isoniazid, rifampicin, ethambutol and pyrazinamide for 2 months followed by rifampicin, and pyrazinamide for 4 months
d. Streptomycin, rifampicin, ethambutol and pyrazinamide for 2 months followed by rifampicin, ethambutol and pyrazinamide for 4 months
e. Moxifloxacin, rifampicin, ethambutol and pyrazinamide for 2 months followed by rifampicin and moxifloxacin for 4 months

Correct answer

b. Rifampicin, ethambutol and pyrazinamide for 6 months

The overall goals for treatment of tuberculosis (TB) are 1) to cure the individual patient, and 2) to minimise the transmission of *M. tuberculosis* to other persons. For this reason, the prescribing physician is carrying out a public health function with responsibility not only for prescribing an appropriate initial regimen but also for successful completion of therapy. Using rapid molecular-based tests, drug resistance can be confirmed or excluded within 1–2 days. Such tests are available in many European countries and the results should be used to guide treatment. If rapid drug susceptibility tests are not available, empirical treatment should be started. For initial empiric treatment of TB, the patient was started on a four-drug standard regimen consisting in isoniazid, rifampicin, pyrazinamide and either ethambutol or streptomycin. Once the TB isolate is known to be fully susceptible, ethambutol (or streptomycin, if it is used as a fourth drug) can be discontinued.

Recent global surveys have reported a trend toward an increasing number of cases of drug-resistant TB. Isoniazid is an important first-line agent for the treatment of TB because of its potent early bactericidal activity. However, resistance to isoniazid is very common, with a prevalence rate of 28% among previously treated cases and 10% among new cases. Studies have reported a low rate of treatment failure (2%) for isoniazid-resistant strains treated with an initial regimen of 4 to 5 drugs containing rifampin for at least 6 months. Therefore, the American Thoracic Society (ATS), Centers for Disease Control and Prevention (CDC), and Infectious Diseases Society of America (IDSA) issued guidelines recommending initial treatment with a standard 4-drug regimen (isoniazid, rifampin, pyrazinamide, and ethambutol) for 2 months followed by 4 months 2 drug regimen (isoniazid, rifampicin). If there is isoniazid resistance treatment should be continued with rifampicin pyrazinamide and ethambutol for a total of 6 months.

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HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 48%

Question 2

A 68-year-old man, who smoked for 20 years but stopped 15 years ago, experiences an acute myocardial infarction. Arterial blood gases 4 h after admission are P_{aO_2} 8.00 kPa (60 mmHg), P_{aCO_2} 4.40 kPa (33 mmHg) and pH 7.44. The chest radiograph is shown below.

Now, 18 h later, the patient is much more dyspnoeic and is receiving nasal oxygen at a rate of 4 $L \cdot min^{-1}$. The neck veins have become more distended in the sitting position, the pulse rate is 128 beats per minute and regular, and a distinct summation gallop is noted at the sixth interspace in the anterior axillary line. Late inspiratory crackles are heard bilaterally halfway up the chest. The arterial blood gases are P_{aO_2} 6.4 kPa (48 mmHg), P_{aCO_2} 8.5 kPa (64 mmHg), and pH 7.24.
Which is the most likely explanation for the hypercapnia?

a. Unrecognised obstructive lung disease
b. Unrecognised laryngeal oedema causing upper airway obstruction
c. Pulmonary oedema secondary to increased capillary permeability
d. Advanced cardiogenic pulmonary oedema
e. Decreased sensitivity of the carotid body

Correct answer

d. Advanced cardiogenic pulmonary oedema

Cardiogenic pulmonary oedema is due to the passage of fluid through the alveolar–capillary membrane as a result of an increase in the pulmonary venous pressure. Clinical features in cardiac pulmonary oedema consist of impaired gas (oxygen) exchange initially resulting in hypoxaemia causing tachypnoea and hypocapnia in order to lessen the hypoxaemia. Auscultation of the lungs reveals fine, crepitant rales, usually heard at the bases first and, as the condition worsens, progress to the apices. A left-sided S3, an accentuation of the pulmonic component of S2, and a jugular venous distention could also be observed. If hypercapnia develops in a patient with cardiogenic pulmonary oedema this is usually due to a failure of the respiratory pump (exhausting of the inspiratory muscles) or the result of underlying COPD. 4 h after admission, arterial blood gases revealed hypoxaemia with hypocapnia, which is typically associated with a cardiogenic pulmonary oedema. Furthermore, the chest radiograph on admission is compatible with left ventricular failure, so the most likely diagnosis is an advanced cardiogenic pulmonary oedema.

Laryngeal stridor, indicative of laryngeal oedema, is absent.

Carotid bodies are sensory organs that regulate respiratory responses to alterations in P_{aO_2}. Decreased sensitivity of the carotid body is classically associated with prolonged hypoxaemia (at least weeks) and could affect plasma carbon dioxide levels.

In this patient hypercapnia has appeared only 18 h after the first arterial blood gas analysis. This is suggestive of a failure of the respiratory pump due to exhaustion of the inspiratory muscles. Although unrecognised COPD cannot be fully excluded because spirometry is not available, the chest radiograph is not (severely) hyperinflated and the medical history did not mention COPD. Furthermore, there are no precipitating causes for non-cardiogenic pulmonary oedema in this patient.

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HERMES Syllabus link: 18 Respiratory failure
Angoff rating: 66%

Question 3

Which of the following statements about CPAP treatment in OSAS is/are true?

a. CPAP is currently the most effective treatment for severe OSAS.
b. The CPAP therapeutic principle in OSAS is the application of positive pressure to splint the pharyngeal lumen.
c. The nasal pressure required for treatment of OSAS depends on the number of respiratory events.
d. The nasal pressure required for treatment of an OSAS patient depends on factors such as body posture, alcohol ingestion or drug treatment.

Correct answers

a. CPAP is currently the most effective treatment for severe OSAS.
b. The CPAP therapeutic principle in OSAS is the application of positive pressure to splint the pharyngeal lumen.
d. The nasal pressure required for treatment of an OSAS patient depends on factors such as body posture, alcohol ingestion or drug treatment.

CPAP is the recommended therapy in patients with moderate and severe OSA, and in those with symptomatic mild OSA which does not respond to other interventions. The fundamental cause of OSA is upper airway collapse and CPAP acts as a pneumatic splint to prevent this collapse. There is no clear relationship between AHI and the pressure required to maintain airway patency and correct AHI, but the pressure required may be increased in the supine position, during rapid eye movement sleep, or after alcohol or sedative ingestion.

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HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 65%

Question 4

A 22-year-old man is admitted to the emergency department after blunt chest trauma from the steering wheel in a motor vehicle accident. He is conscious and his vital signs are stable. There is no evidence of other injury. The chest radiograph shows a right pleural effusion occupying about half of the hemithorax. There are no obvious rib fractures and no pneumothorax.

Table Pleural fluid analysis

Appearance	**Bloody**
Nucleated cells per µL	12000
Differential cell count %	
Neutrophils	80
Lymphocytes	15
Macrophages	5
Total protein g·dL^{-1}	5.5
Lactate dehydrogenase U·L^{-1}	500
Glucose mg·dL^{-1}/mmol·L^{-1}	100/5.55
pH	7.38
Pleural fluid/peripheral blood haematocrit ratio %	60

The most appropriate management is:

a. Observation
b. Chest tube placement
c. Intrapleural urokinase
d. Therapeutic needle aspiration
e. Thoracotomy

Correct answer

b. Chest tube placement

This patient suffers from a haemothorax due to blunt chest trauma. Haemothorax is defined as a pleural effusion with a haematocrit >50% of that of the peripheral blood. Haemothorax is initially treated with tube thoracostomy using a large bore (36F or wider) chest tube.
Haemothorax should be drained because it is a major risk factor for the development of empyema after chest trauma. Untreated haemothorax may lead to fibrothorax, lung entrapment and impaired pulmonary function.
Intrapleural urokinase is dangerous because it would possibly increase the traumatic bleeding.
Therapeutic needle aspiration is a one-time procedure and will not allow monitoring of continuing intra-thoracic bleeding, which can be observed after chest tube insertion.
Massive immediate bloody drainage of ≥1500 mL after placement of a chest tube is considered an indication for surgical thoracotomy. Shock and persistent, substantial bleeding (generally >3 $mL \cdot kg^{-1} \cdot h^{-1}$) are indications for thoracotomy. Vital signs, fluid resuscitation requirements and concomitant injuries are considered when determining the need for thoracotomy.

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HERMES Syllabus link: 20 Pleural diseases, 27 Associated specialties
Angoff rating: 68%

Question 5

Regarding *Pneumocystis jiroveci* pneumonia in HIV-infected patients, which of the following statement(s) is/are correct?

a. Most patients have CD4 counts <200 cells per μL at the time of diagnosis of their first episode of *P. jiroveci* pneumonia.
b. Most patients with *P. jiroveci* pneumonia will have an elevated serum lactate dehydrogenase level.
c. Arterial blood gases in patients with *P. jiroveci* pneumonia frequently reveal respiratory alkalosis and a widened alveoloarterial oxygen tension difference.
d. A normal chest radiograph rules out the diagnosis.

Correct answers

a. Most patients have CD4 counts <200 cells per µL at the time of diagnosis of their first episode of *P. jiroveci* pneumonia.
b. Most patients with *P. jiroveci* pneumonia will have an elevated serum lactate dehydrogenase level.
c. Arterial blood gases in patients with *P. jiroveci* pneumonia frequently reveal respiratory alkalosis and a widened alveoloarterial oxygen tension difference.

Two studies performed in the 1990s showed that a CD4 count of <200 cells per µL in patients with HIV infection carries an increased risk of *P. jiroveci* pneumonia. In one of these studies, over 95% of *P. jiroveci* pneumonia patients had a CD4 count of <200 cells per µL. Increased serum lactate dehydrogenase (LDH) is present in >90% of patients; a normal LDH has a high negative predictive value. A widened alveoloarterial oxygen tension difference with hypoxaemia is frequently seen in patients with *P. jiroveci* pneumonia. The resulting hyperventilation induces hypocapnia with (compensated) respiratory alkalosis. About 25% of patients with *P. jiroveci* pneumonia present with a normal chest radiograph.

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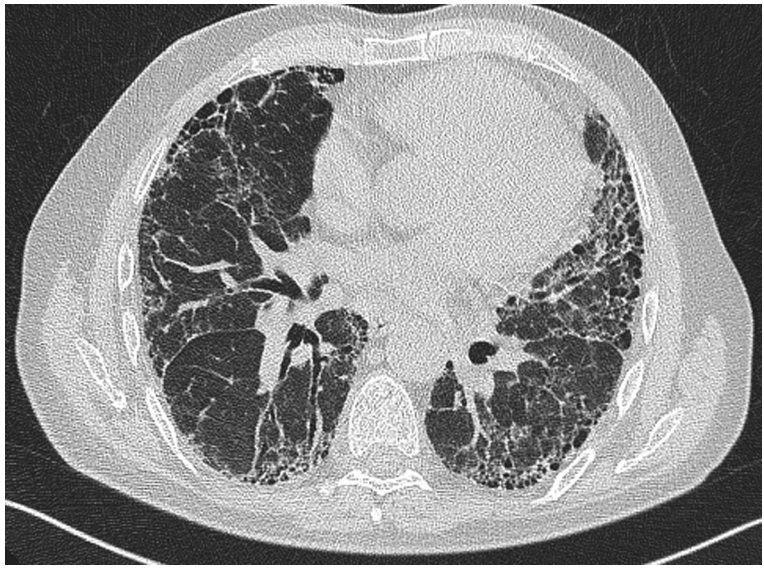
HERMES Syllabus link: 7 Respiratory infections, 24 Immunodeficiency disorders
Angoff rating: 61%

Question 6

A 60-year-old female is referred for dyspnoea on exertion and chronic cough. Her dyspnoea and cough have worsened continuously during the past 12 months. Pulmonary function testing reveals an FVC of 72% predicted, FEV_1 of 80% predicted and a T_{LCO} of 38% predicted. A representative slice of the chest CT is shown below. Open-lung biopsy reveals randomly distributed foci of scarring with fibroblasts surrounded by normal lung parenchyma.



What is the most appropriate therapy for this patient?

a. Pirfenidone
b. Bosentan
c. Acetylcysteine
d. Prednisolone/azathioprine
e. Supportive care

Correct answer

a. Pirfenidone

Idiopathic pulmonary fibrosis (IPF) is defined as a specific form of chronic, progressive, fibrosing, interstitial pneumonitis of unknown cause, occurring primarily in older adults. It is characterised by progressive worsening of dyspnoea and lung function, and is associated with a poor prognosis. CT is an essential component of the diagnostic pathway in IPF. The usual interstitial pneumonitis (UIP) pattern on CT is characterised by the presence of reticular opacities, often associated with traction bronchiectasis. Honeycombing is common and is critical for making a definite diagnosis. If honeycombing is absent but the imaging features otherwise meet criteria for UIP, the imaging features are regarded as representing possible UIP and surgical lung biopsy is necessary to make a definitive diagnosis. The histopathological hallmark and principal diagnostic criterion in lung biopsy is a heterogeneous appearance at low magnification in which areas of fibrosis with scarring and honeycomb alternate with areas of less affected or normal parenchyma (UIP pattern).

Until recently, there was insufficient evidence to support the use of any specific pharmacological therapy for patients with IPF. Bosentan was not recommended in patients with IPF based on the potential risks and cost of therapy, and the low quality of relevant clinical data. In addition, the majority of patients with IPF should not be treated with acetylcysteine monotherapy. This recommendation is based on the potential cost of therapy and on low-quality data, including the absence of a true 'no therapy' arm in related studies. The combination of corticosteroids and immunomodulator therapy (azathioprine) is not recommended in IPF patients due to treatment-related morbidity and the lack of appropriate prospective clinical trials. Pirfenidone is currently the only approved drug for the treatment of adult patients with mild to moderate IPF (FVC ≥50% predicted value and single-breath T_{LCO} >30% predicted). Data from phase III, randomised, double-blind, placebo-controlled trials demonstrate that pirfenidone reduces the decline in lung function and improves progression-free survival time. In these studies, treatment with pirfenidone was safe and generally well tolerated. The most commonly reported adverse events were gastrointestinal events and skin sensitivity to sunlight. These were generally mild to moderate in severity and rarely resulted in treatment discontinuation.

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HERMES Syllabus link: 10 Interstitial lung disease
Angoff rating: 58%

Question 7

A 32-year-old, HIV-positive man presents with dyspnoea, nonproductive cough and fever. Physical examination reveals a temperature of 39.4ºC; the chest examination is normal. His medical records show that he was hospitalised to an AIDS ward 6 weeks ago during an unrecognised outbreak of drug-resistant tuberculosis.
Which of the following tests would be helpful in the evaluation of this patient?

a. A chest radiograph
b. Sputum culture for mycobacteria
c. A tuberculin skin test
d. An interferon-γ release assay

Correct answers

a. A chest radiograph
b. Sputum culture for mycobacteria

After close contact with a person with active tuberculosis, as in this case, active tuberculosis has to be vigorously sought by microscopic sputum examination and culture, chest radiography, and other clinical examinations as appropriate. The tuberculin skin test has no role in the diagnosis of active tuberculosis because it cannot differentiate between latent and active disease; additionally, the tuberculin skin test is often falsely negative in HIV-infected patients due to their impaired immune response. The same holds true for the interferon-γ release assay, although its specificity for *Mycobacterium tuberculosis* is greater than that of the skin test.

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HERMES Syllabus links: 8 Mycobacterial diseases
Angoff rating: 62%

Question 8

Which of the following statements concerning the use of supplemental oxygen in patients with COPD is/are correct?

a. Long-term oxygen therapy improves survival in patients with stable COPD with severe hypoxaemia.
b. Continuous oxygen therapy decreases pulmonary vascular resistance in patients with stable hypoxaemic COPD.
c. Continuous oxygen therapy decreases the level of polycythaemia in patients with stable hypoxaemic COPD.
d. Oxygen administration increases V'_E in patients with acute hypoxaemic exacerbations of COPD.

Correct answers

a. Long-term oxygen therapy improves survival in patients with stable COPD with severe hypoxaemia.
b. Continuous oxygen therapy decreases pulmonary vascular resistance in patients with stable hypoxaemic COPD.
c. Continuous oxygen therapy decreases the level of polycythaemia in patients with stable hypoxaemic COPD.

Long-term oxygen administration in stable COPD with significant hypoxaemia (*i.e.* P_{aO_2} <7.33 kPa (<55 mmHg)) has resulted in prolonged survival (Nocturnal Oxygen Therapy Trial Group, 1980; and Medical Research Council Working Party, 1981). Long-term oxygen administration also results in slight decrease and then stabilisation of pulmonary artery pressure, due to a decrease in pulmonary vascular resistance by reversing the vasoconstrictor effect of alveolar hypoxia. Although not formally proven, it also results in a decrease in the level of polycythaemia, probably due to a decrease in erythropoietin secretion secondary to better oxygenation. In patients with either cor pulmonale or polycythaemia (haematocrit >55%), continuous oxygen therapy has been shown to improve survival in patients with a resting P_{aO_2} between 7.33 kPa (55 mmHg) and 8.00 kPa (60 mmHg).
Severe hypoxaemia is associated with increased V'_E, and correction of hypoxaemia (or worse, hyperoxia) may be associated with decreased V'_E by removing the hypoxaemic stimulus; this effect is more pronounced in chronic hypercapnic patients. Hypoventilation (with associated hypercapnia and respiratory acidosis) seen in severe acute COPD exacerbations can be treated only by noninvasive or, less preferably, invasive mechanical ventilation.

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HERMES Syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases
Angoff rating: 70%

Question 9

During resting tidal breathing, mean inspiratory airflow is greater than mean expiratory airflow. Which one of the following explains this finding?

a. Expiratory muscle activity
b. Increased turbulence
c. Decreased compliance of the respiratory system
d. Increased humidity
e. Increased airway radius

Correct answer

e. Increased airway radius

Airflow is governed by the Poiseuille equation, which states that flow is inversely proportional to the airway radius to the fourth power and the viscosity of the fluid. The radius of the airway is increased during inhalation due to the fact that the airway parenchyma is tethered to the airways; radial traction pulls the airways open. Humidity in the lower airways affects the airflow but it is normally 100% during inspiration and expiration, and it has a negligible effect, while small changes in the airway radius during inhalation and exhalation are magnified to cause large changes in airway resistance. The changes in compliance during tidal breathing have only a minimal effect on the difference between inspiratory and expiratory airflow.

Reference

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HERMES Syllabus link: 1 Structure and function of the respiratory system, 3 Pulmonary function testing
Angoff rating: 52%

Question 10

In a study, pulse oximetry detected OSAS with a sensitivity of 70 % and a specificity of 96% compared with polysomnography. Male sex and older age are known risk factors for OSAS.
Which of the following conclusion(s) can be drawn from this information?

a. Polysomnography should be done to confirm sleep apnoea when pulse oximetry suggests the presence of OSAS.
b. In a population of older men the positive predictive value of pulse oximetry is higher than in a general population.
c. Pulse oximetry is an ideal screening tool for OSAS.
d. A positive test in a young woman is more likely to be false positive than in an older man.

Correct answers

b. In a population of older men the positive predictive value of pulse oximetry is higher than in a general population.
d. A positive test in a young woman is more likely to be false positive than in an older man.

Sensitivity is the ability of a test to correctly classify an individual as 'diseased' when compared with a gold-standard, in this case the polysomnography. Therefore, if a test with even a low sensitivity but a high specificity is positive, the disease is confirmed, and no test with a higher sensitivity is warranted.
The positive predictive value (PPV) is the percentage of patients with a positive test who actually have the disease (table). Positive and negative predictive values (NPVs) are directly related to the prevalence of the disease in the population. Assuming all other factors remain constant, the PPV will increase with increasing prevalence and *vice versa*, the NPV decreases with increase in prevalence. In general, screening tools should be highly sensitive in order not to miss affected cases, but specificity should not be too low as too many false positive cases would require further evaluation. By contrast, confirmation tests are requested to be highly specific, in order not to misclassify 'healthy' people as 'diseased'.

Table Definition of terms

Sensitivity	True positives/positives
Specificity	True negatives/negatives
Positive predictive value	True positives/(true positives + false negatives)
Negative predictive value	True negatives/(true negatives + false negatives)
Accuracy	(True positives + true negatives)/(positives + negatives)

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HERMES Syllabus link: 4 Other diagnostic procedures, 22 Sleep and control of breathing disorders
Angoff rating: 45%

Question 11

A 45-year-old female is admitted to the hospital because of severe dyspnoea and acute chest pain. Fever and cough are not present on admission. The patient reports mild dyspnoea on exertion for the past 2 years and an episode of pneumothorax 6 months ago. On admission, her blood pressure is 130/80 mmHg, her heart rate is 100 beats per min and regular, and her respiratory rate is 32 breaths per min. Chest radiography reveals small bilateral pneumothoraces. CT shows multiple round cysts involving the whole parenchyma; three micronodules, enlargement of axillary lymph nodes and a renal mass were also detected.
Which of the following statements about this case is/are correct?

a. The diagnosis requires lung histology.
b. Lung cysts are the hallmark lesion.
c. Echocardiography is recommended in the follow-up.
d. There is a strong association with female gonadotropic hormones.

Correct answers

b. Lung cysts are the hallmark lesion
d. There is a strong association with female gonadotrophic hormones

Lymphangioleiomyomatosis (LAM) is a rare lung disease characterised by progressive replacement of the lung parenchyma by cysts, which are the hallmark lesion in LAM. Definite LAM diagnosis can be made by lung histology or by the detection of characteristic lung CT lesions associated with one of the following: angiomyolipoma, chylous effusion lymphangioleiomyoma, lymph-node involvement or the tuberous sclerosis complex. In the evaluation of disease progression, cardiopulmonary exercise testing and 6-min walk tests are recommended. Routine screening for pulmonary hypertension is not recommended because pulmonary hypertension has not been reported frequently in cohorts of patients with LAM. LAM occurs almost exclusively in females of child- bearing age or in those receiving female gonadotropic hormones. This is thought to be related to oestrogen receptors, which could be demonstrated on the abnormal smooth muscle cells and that control cell growth and proliferation. Langerhans cell histiocytosis is unlikely because of the kidney mass and the enlarged lymph nodes.

References

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HERMES Syllabus link: 25 Orphan and rare lung diseases
Angoff rating: 65%

Question 12

A 47-year-old technician is evaluated for chronic cough and progressive dyspnoea on slight exertion. On pulmonary function testing, both FVC and FEV_1 are 80% predicted, and T_{LCO} is 35% pred. Arterial blood gases show a pH of 7.45, P_{aO_2} of 7.3 kPa (55 mmHg) and P_{aCO_2} of 4.4 kPa (33 mmHg). The chest radiograph is remarkable for bilateral hilar enlargement and infiltrates of both lungs. Chest CT confirms bilateral hilar adenopathy and patchy lung infiltrates, predominantly of the upper lobes. A small pericardial effusion and small ascites around the liver are also noted. Bronchoscopy is performed. Bronchoalveolar lavage (BAL) reveals an elevated cell count of 760 cells per μL, with 6% neutrophils, 33% lymphocytes and 61% macrophages. Bacterial cultures of the BAL fluid remain sterile and no acid-fast bacilli are found. Mycobacterial cultures are pending. Transbronchial needle aspiration of the hilar lymph nodes demonstrates multiple noncaseating granulomas.
What would be the most appropriate next diagnostic evaluation in this patient?

a. 24-h urinary calcium excretion
b. Transbronchial lung biopsy
c. 6-min walking test
d. Echocardiography
e. Liver biopsy

Correct answer

d. Echocardiography

The patient suffers from stage 2 sarcoidosis confirmed by typical CT findings including bilateral hilar adenopathy and predominant upper lobe infiltrates; transbronchial needle aspiration shows noncaseating granulomas characteristic of sarcoidosis. The severity of the dyspnoea, as well as the hypoxaemia and the severe diffusion defect, are not sufficiently explained by the stage 2 sarcoidosis. Small pericardial effusion and ascites may be signs of right heart failure, so the patient should undergo echocardiography in search of sarcoidosis-associated pulmonary hypertension (SAPH). SAPH is reported with a prevalence of 5–50% in patients with symptomatic sarcoidosis and can be treated with prostacyclins, bosentan and sildenafil. Prednisone would be the initial therapy for symptomatic uncomplicated sarcoidosis, while infliximab is a second-line treatment.
Urine sampling to measure calcium excretion would be indicated if sarcoidosis induced hypercalcaemia was suspected. Transbronchial lung biopsy is superfluous because fine-needle aspiration of mediastinal lymph nodes has already proven noncaseating granulomas. A 6-min walking test is helpful to document the severity of the disease and the success of the therapy for pulmonary hypertension, but it is not indicated for diagnostic purposes. Liver biopsy to confirm a second organ involvement of sarcoidosis is not necessary if radiological findings and biopsy results are characteristic for sarcoidosis.

Reference

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HERMES Syllabus link: 10 Interstitial lung disease
Angoff rating: 49%

Question 13

A 75-year-old female is referred for dyspnoea on exertion and chronic cough that have worsened progressively over the past 12 months. Pulmonary function testing reveals an FVC of 72% predicted, FEV_1 of 80% predicted and T_{LCO} of 38% predicted. The chest radiograph shows bilateral patchy infiltrates, mostly at the lung bases. On HRCT, bilateral reticular opacities and clustered basal honeycombing are found. Open-lung biopsy reveals randomly distributed foci of usual interstitial pneumonia surrounded by normal lung parenchyma.
What is the most appropriate therapy for this patient?

a. Pirfenidone
b. Bosentan
c. Acetylcysteine
d. Prednisolone/azathioprine
e. Supportive care

Correct answer

a. Pirfenidone

This patient suffers from idiopathic pulmonary fibrosis (IPF) that has worsened during the past year. There are no signs of a current flare; corticosteroids may be used when IPF exacerbates. The other treatments listed have not been shown to provide clinical benefit.

References

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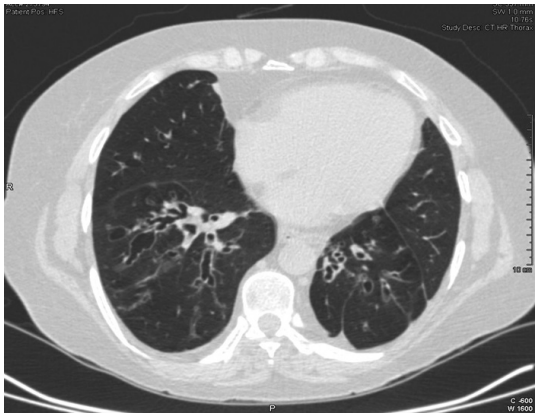
HERMES Syllabus link: 5 Treatment modalities and prevention measures, 10 Interstitial lung disease
Angoff rating: 48%

Question 14

A 46-year-old male presents to your outpatient clinic. He suffers from increasing shortness of breath, increasing amounts of sputum and recurrent bronchopulmonary infections. He has infertility and had two operations for nasal polyposis and recurrent sinusitis. His lung function shows a combined obstructive–restrictive pattern. The CT scan of the thorax shows abnormalities in both lower lobes (below). Liver function tests and blood glucose concentration are within normal limits. Which one of the following is the most likely diagnosis in this patient?



a. Allergic bronchopulmonary aspergillosis
b. Cystic fibrosis
c. Idiopathic bronchiectasis
d. Primary ciliary dyskinesia (Young's syndrome)
e. Mounier–Kuhn syndrome

Correct answer

d. Primary ciliary dyskinesia (Young's syndrome)

The complex symptoms described here fit a diagnosis of primary ciliary dyskinesia (PCD), a genetic disorder of cilia structure and function. Cells lining the nasopharynx, middle ear, paranasal sinuses, the lower respiratory tract and the reproductive tract contain cilia and are generally affected in PCD when the disease is fully expressed. PCD leads to chronic infections of the upper and lower respiratory tract, impaired fertility and disorders of organ laterality.

In contrast to cystic fibrosis, pancreatic function is preserved and hepatobiliary disease is usually absent. The clinical course is milder than in cystic fibrosis, without nutritional problems and diabetes. In allergic bronchopulmonary aspergillosis (ABPA), the localisation of bronchiectasis would be central or preferably in the upper lobes. Nasal polyposis and infertility are not associated with ABPA. Idiopathic bronchiectasis is equally not associated with nasal polyps and infertility. Mounier-Kuhn disease refers to tracheobronchomegaly. The disease may be associated with collagen tissue diseases such as Ehlers–Danlos syndrome. Symptoms are chronic unproductive cough, recurrent bronchopneumonia and irritative respiratory symptoms. On a CT scan, the trachea would show enlargement.

References

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HERMES Syllabus link: 6 Airway diseases, 26 Genetic and developmental disorders
Angoff rating: 61%

Question 15

Which of the following statements regarding treatment of sleep-related breathing disorders is correct?

a. Auto-adjusting nasal CPAP is superior to constant-pressure CPAP for suppression of apnoea/hypopnoea.
b. Bilevel positive airway pressure therapy is preferable to CPAP in obesity hypoventilation syndrome without severe nocturnal oxygen desaturation.
c. Adaptive servoventilation has been shown to reduce mortality in nocturnal Cheyne–Stokes respiration due to left heart failure.
d. Evidence from a nonrandomised study suggests a reduction of cardiovascular morbidity with CPAP in patients with obstructive sleep apnoea syndrome.
e. CPAP reduces mortality in central sleep apnoea.

Correct answer

d. Evidence from a nonrandomised study suggests a reduction of cardiovascular morbidity with CPAP in patients with obstructive sleep apnoea syndrome.

Although auto-CPAP is commonly used in the treatment of obstructive sleep apnoea syndrome (OSAS), algorithms with auto-adjusting treatment pressure did not consistently yield better results than treatment with CPAP at a fixed pressure regarding apnoea/hypopnoea and oxygen desaturations. Some studies showed higher patient preference and adherence with auto-CPAP than with fixed-pressure CPAP.

In obesity hypoventilation syndrome, impaired central respiratory drive plays an important role. Nonetheless, timed bilevel positive airway pressure has not been shown to be superior to CPAP. Both CPAP and bilevel positive airway pressure appear to be equally effective in improving daytime hypercapnia in a subgroup of patients with obesity hypoventilation syndrome without severe nocturnal hypoxaemia.

Although adaptive pressure support ventilation can improve central sleep apnoea (CSA) and Cheyne–Stokes respiration (CSR) in heart failure patients, definitive data on the effect of this treatment on mortality are not yet available. Preliminary results of the SERVE-HF trial even suggest that adaptive servoventilation may be associated with a higher mortality in a subgroup of patients with Cheyne-Stokes respiration due to congestive heart failure with a low left ventricular ejection fraction (<45%).

In a large observational landmark study extending over several years, Marin *et al.* (2005) observed that overall mortality and cardiovascular events were reduced in patients with OSAS regularly using CPAP compared with untreated OSAS patients. The odds ratio for nonlethal cardiovascular events or mortality varies from 2 to 7 for moderate-to-severe OSAS compared with non-OSAS controls. A common methodological problem is finding an adequate control group for this type of analysis.

Nocturnal CPAP has been shown to improve nocturnal CSR/CSA, oxygen saturation, left ventricular ejection fraction, sympathetic nervous system activity and 6-min walking distance in patients with heart failure and CSR/CSA. However, CPAP did not prolong survival without heart transplantation during a 2-year follow-up in a large trial (Canadian Continuous Positive Airway Pressure for Patients with Central Sleep Apnea and Heart Failure). Nevertheless, a *post hoc* analysis suggested a survival benefit in the subgroup of patients in whom CPAP significantly lowered the AHI.

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HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 55%

Question 16

Which of the following statements concerning exudative pleural effusions is/are true?

a. In parapneumonic effusions, a pH ≤7.0 suggests a complicated or loculated effusion, which may progress to empyema.
b. In contrast to low pleural fluid pH, pleural fluid glucose is usually normal in complicated parapneumonic effusions.
c. Lymphocytosis on pleural fluid differential cell counting often occurs in malignant or tuberculous effusions.
d. Adenosine deaminase levels of pleural fluid are often elevated in tuberculous effusions.

Correct answers

a. In parapneumonic effusions, a pH ≤7.0 suggests a complicated or loculated effusion, which may progress to empyema.
c. Lymphocytosis on pleural fluid differential cell counting often occurs in malignant or tuberculous effusions.
d. Adenosine deaminase levels of pleural fluid are often elevated in tuberculous effusions.

In pleural effusion of unknown cause, diagnostic thoracocentesis may help in elaborating the clinical diagnosis. The sampled pleural fluid should be sent for biochemical, microbiological and cytological analyses. Biochemical analyses include determination of protein, pH, lactate dehydrogenase and glucose levels. A pH <7.2 indicates a complicated parapneumonic effusion or empyema but may also occur in oesophageal rupture, rheumatoid arthritis and malignant neoplasm. Glucose levels are typically low in complicated parapneumonic effusions. Pleural fluid acidosis reflects an increase in lactic acid and carbon dioxide production due to locally increased anaerobic metabolic activity.
Tuberculous pleurisy often causes lymphocytic effusions but lymphocytosis is also frequently seen in other disorders like rheumatoid pleurisy, sarcoidosis and yellow nail syndrome, after coronary artery bypass graft surgery, and in pleural malignancy such as metastases, mesothelioma or lymphoma. When tuberculosis is suspected, an elevated level of adenosine deaminase (>40 $U \cdot L^{-1}$) in the pleural fluid confirms the diagnosis with a sensitivity of >90% and a specificity of 85%. In lymphocyte-predominant effusions, the specificity of adenosine deaminase for tuberculosis reaches values up to 95%.

References

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HERMES Syllabus link: 20 Pleural diseases
Angoff rating: 60%

Question 17

A 54-year-old man with ischaemic cardiomyopathy undergoes coronary artery bypass surgery for severe proximal obstructive lesions. He is mechanically ventilated in pressure support mode overnight. The morning after surgery, he has several pulmonary artery wedge pressure readings of 18 mmHg but his chest radiography shows no evidence of congestive heart failure. He undergoes extubation and initially does well but 2 h later he experiences rapid onset of dyspnoea. His chest radiography now shows pulmonary oedema. An ECG shows sinus tachycardia but no evidence of myocardial ischaemia.
Which of the following functional abnormalities related to discontinuation of mechanical ventilation is the most likely cause of the pulmonary oedema?

a. Increased left ventricular preload and afterload
b. Shift of the ventricular septum toward the left because of decreased intrathoracic pressure
c. Increased pulmonary vascular resistance
d. Increased intrapleural pressure during inspiration
e. Decreased right ventricular preload because of decreased intrathoracic pressure

Correct answer

a. Increased left ventricular preload and afterload

Cardiac dysfunction is one of the most frequent causes of weaning failure. Switching from mechanical ventilation to spontaneous breathing can unmask latent left ventricular failure by increasing preload and afterload, and thus induce pulmonary oedema. Cessation of mechanical ventilation decreases the intrathoracic pressure so that the venous return to the heart (*i.e.* the preload) increases; the decreased intrathoracic pressure also increases the pressure gradient between the left ventricle and the great arteries so that the left ventricular afterload increases. Repeated pulmonary artery wedge pressure measurements of 18 mmHg strongly suggest left ventricular failure that is kept latent by mechanical ventilation.

Decreased intrathoracic pressure during spontaneous breathing will increase right ventricular preload but there is no increase in pulmonary vascular resistance. Therefore, there is no increase in the pulmonary artery pressure and, secondarily, right ventricular systolic pressure that would cause a shift of the ventricular septum toward the left, as is the case in severe pulmonary hypertension. Intrapleural pressure during inspiration in spontaneous breathing is negative.

Reference

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HERMES Syllabus link: 1 Structure and function of the respiratory system, 4 Other diagnostic procedures
Angoff rating: 40%

Question 18

Which of the following statements about cystic fibrosis is/are correct?

a. The most common mutation is Phe508del on chromosome 7.
b. Pathogens such as *Pseudomonas aeruginosa*, *Burkholderia cepacia*, *Staphylococcus aureus* and *Escherichia coli* are found in early stages of the disease.
c. Congenital bilateral absence of the vas deferens leads to infertility in men with cystic fibrosis.
d. Long-term, low-dose macrolide therapy (azithromycin) should be considered for patients who are chronically infected with *P. aeruginosa*.

Correct answer

a. The most common mutation is Phe508del on chromosome 7.
c. Congenital bilateral absence of the vas deferens leads to infertility in men with cystic fibrosis.
d. Long-term, low-dose macrolide therapy (azithromycin) should be considered for patients who are chronically infected with *P. aeruginosa*.

Cystic fibrosis is a genetic disease. It is caused by mutations in the cystic fibrosis transmembrane conductance regulator (*CFTR*), the most frequent of which is the Phe508del on chromosome 7. Deranged chloride transport leads to thick, viscous secretions in the lungs, pancreas, liver, intestine and reproductive tract. The symptoms include persistent pulmonary infection and pancreatic insufficiency. A positive sweat chloride test and/or genetic analysis confirm the diagnosis. The viscous mucus also disturbs the embryological development of the vas deferens, which leads to male infertility. As the disease progresses, but not in the early stages of cystic fibrosis, bacteria such as *P. aeruginosa* and *S. aureus*, which are not seen in healthy lungs, colonise the airways of cystic fibrosis patients. *E. coli* has only recently been recognised as a critical pathogen in cystic fibrosis. Recent studies have shown that long-term, lose-dose macrolide therapy can reduce frequency of exacerbations in cystic fibrosis patients colonised with *P. aeruginosa*.

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HERMES examination blueprint: 6 Airway diseases, 26 Genetic and developmental disorders
Angoff rating: 58%

Question 19

Which of the following statements concerning the management of diffuse malignant mesothelioma of the pleura is/are true?

a. Positron emission tomography is essential for staging if resection is planned.
b. The most useful chemotherapy consists of a combination of cisplatin plus pemetrexed or gemcitabine.
c. Talc pleurodesis should be avoided because it creates additional pain.
d. Palliative surgery includes extrapleural pneumonectomy.

Correct answers

a. Positron emission tomography is essential for staging if resection is planned.
b. The most useful chemotherapy consists of a combination of cisplatin plus pemetrexed or gemcitabine.

Positron emission tomography is used to rule out extrathoracic metastasis in patients considered for pneumonectomy and decortication, or radical surgical treatment with extrapleural pneumonectomy with *en bloc* resection of the pericardium and hemidiaphragm. Positron emission tomography should be performed before any pleurodesis.
A combined first-line regimen using cisplatin and pemetrexed is considered the gold standard for treatment. Gemcitabine and cisplatin may be used for patients who cannot take pemetrexed. Pleurodesis is useful in preventing recurrent effusions, and management of dyspnoea and pain. Talc is preferred over other agents for pleurodesis.
There is limited evidence for the efficacy of radical surgery for mesothelioma. Extrapleural pneumonectomy should only be performed in clinical trials, in specialised centres or as part of multimodal treatment, and is not part of a palliative approach. Palliative treatment is performed for relief of dyspnoea and pain; local procedures include parietal pleurectomy or talc pleurodesis.

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HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 63%

Question 20

Which of the following conditions will tend to increase the ventilation/perfusion ratio (*i.e.* increase West zone 1) and therefore the dead space ventilation in the top part of the lung?

a. A change in posture, from standing to lying down
b. Increase in positive end-expiratory pressure in a patient ventilated for acute respiratory distress syndrome
c. Severe mitral stenosis
d. Pneumothorax
e. Rapid deceleration in a bungee jump

Correct answer

b. Increase in positive end-expiratory pressure in a patient ventilated for acute respiratory distress syndrome

In West zone 1, there is a mismatch between ventilation and perfusion, with an absence of perfusion in a ventilated area, *i.e.* dead space. Ventilation/perfusion ratios differ with the distribution of air within the lung and the variation in blood flow due to the influence of gravity, which causes a gradient in blood pressure between the top and bottom of the lung. In the upright position, regional pulmonary arterial blood pressure ranges from 5 mmHg near the apex of the lung to 25 mmHg at the base. Venous pressure falls to –5 mmHg at the apexes and rises to +15 mmHg at the bases. In normal health, pulmonary arterial pressure exceeds alveolar pressure in all parts of the lung; hence, zone 1 is not observed. Mitral stenosis increases venous pressure, reducing the tendency to develop West zone 1. Zone 1 is generally only observed when a person is ventilated with positive pressure. In these circumstances, blood vessels can become completely collapsed by alveolar pressure and blood does not flow through these regions, they become alveolar dead space. Changing position from upright to supine, pneumothorax, and deceleration in head-down position all tend to decrease the likelihood of West zone 1.

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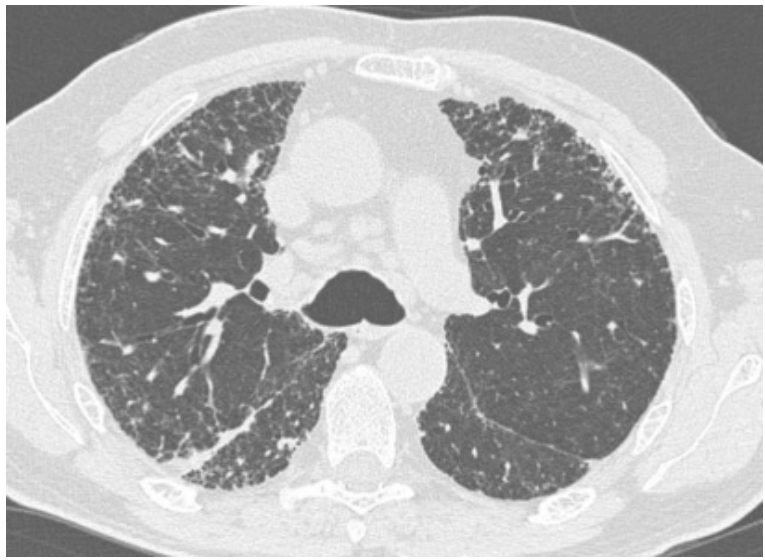
Mélot C. Contribution of multiple inert gas elimination technique to pulmonary medicine. 5. Ventilation–perfusion relationships in acute respiratory failure. *Thorax* 1994; 49: 1251–1258.

HERMES Syllabus link: 1 Structure and function of the respiratory system, 3 Pulmonary function testing
Angoff rating: 40%

Question 21

A 74-year-old never-smoking man, who is former government office worker, complains of a dry cough and progressive shortness of breath (New York Heart Association functional class III) for 6 months. He takes 20 mg enalapril daily for arterial hypertension. He has no other diseases. He has not kept animals, or been exposed to dust or fumes. Auscultation reveals Velcro rales over both lung bases. There is no clubbing. Pulmonary function tests cannot be performed because of impressive, possibly psychogenic, hyperventilation. While breathing room air, arterial blood gas analysis shows P_{aO_2} 9.64 kPa (72 mmHg), P_{aCO_2} 5.47 kPa (41 mmHg), pH 7.36, base excess −1.8 mmol·L^{-1} and S_{aO_2} 94%. His chest CT image is shown below.



Which of the following is the most appropriate initial diagnostic procedure?

a. Measurement of serum precipitating antibodies
b. Laboratory testing for collagen vascular disease
c. Transbronchial biopsy
d. Surgical lung biopsy
e. Bronchoalveolar lavage

Correct answer

b. Laboratory testing for collagen vascular disease

This patient has an interstitial lung disease. His arterial blood gas analysis at rest is normal so the disease is probably in its initial phase. This seems to be compatible with the CT, which shows minimal fibrotic changes. There are discrete increased linear markings with a thickening of the right pleural fissure. No evident nodular lesions, honeycombing or (traction) bronchiectasis are present. Considering the age of the patient, who never smoked, the differential diagnosis includes autoimmune/collagen vascular disease and idiopathic pulmonary fibrosis. In case of suspected hypersensitivity pneumonitis, precipitating antibodies might support the diagnosis in the context of a suggestive history, but neither the clinical history nor the CT is compatible with hypersensitivity pneumonitis. A transbronchial biopsy rarely gives a definitive diagnosis of interstitial lung disease except in cases of sarcoidosis, hypersensitivity pneumonitis, bronchoalveolar carcinoma and lymphangitis carcinomatosa. This is also true for bronchoalveolar lavage (BAL). BAL might give hints to a diagnosis in cases of sarcoidosis, hypersensitivity pneumonitis, bronchoalveolar carcinoma and lymphangitis carcinomatosa, alveolar proteinosis, and Langerhans' cell histiocytosis. Considering the patient's clinical history and CT, these diseases are not likely. Surgical biopsy is indicated if extensive additional investigations (blood tests, bronchoscopy and pulmonary function tests) do not reveal a diagnosis and if the diagnosis might lead to an important therapeutic decision. Considering the differential diagnosis, the first additional diagnostic step in this case should thus be ordering laboratory tests to evaluate possible collagen vascular disease.

Reference

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HERMES Syllabus link: 10 Interstitial lung disease, 13 Respiratory consequences of systemic/extrapulmonary disorders, 16 Environmental diseases
Angoff rating: 50%

Question 22

A 24-year-old male student with cystic fibrosis presents to your office with a 4-week history of increasing dyspnoea and decreased exercise tolerance. His chronic cough productive of 90 mL greenish sputum per day has increased. He was hospitalised 2 years ago for a right pneumothorax. Current medications include pancreatic enzyme replacement, a multiple-vitamin supplement and bronchodilators as needed. He admits to some noncompliance with his daily chest physiotherapy regimen. The patient weighs 60 kg and is 170 cm tall. His pulse rate is 86 beats per min, blood pressure 106/78 mmHg, respiration rate 24 breaths per min, temperature 36.8°C and S_{pO_2} 93%. Chest examination reveals diffuse, coarse crackles and expiratory rhonchi. His laboratory and spirometry results are as follows.

Haematocrit %	41
Leukocytes per μL	11 400
Neutrophils %	78
Lymphocytes %	16
Eosinophils %	2

	6 months ago	Current
FVC % predicted	74	62
FEV1 % predicted	48	40
FEV1/FVC %	70	62

His chest radiograph is shown below.

Which of the following is the most efficacious management option?

a. Initiate intensive inhaled bronchodilator therapy with ipratropium and β-agonists.
b. Initiate intravenous antibiotic therapy with ticarcillin and tobramycin pending sputum culture and sensitivity results.
c. Initiate long-term continuous inhaled antibiotic therapy with high-dose tobramycin.
d. Initiate regular therapy with inhaled recombinant human DNAse.
e. Reinstitute twice-daily chest physiotherapy with postural drainage and use of an airway oscillator.

Correct answer

b. Initiate intravenous antibiotic therapy with ticarcillin and tobramycin pending sputum culture and sensitivity results.

This patient's symptoms are indicative of a pulmonary exacerbation, which is usually due to *Pseudomonas* infection. Moreover, the patient has a history of pneumothorax, which is prognostically unfavorable. Therefore, the patient will need antipseudomonal antibiotic treatment. More intensive physiotherapy would help but it would not be the most efficacious measure for the patient. Guidelines state that there is insufficient evidence for the concurrent use of inhaled and systemic antibiotic treatment, so the patient will need *i.v.* treatment for the exacerbation. Inhaled treatment may be used in the long term in patients with chronic *Pseudomonas* infection.

References

Flume PA, *et al.* Cystic fibrosis pulmonary guidelines: treatment of pulmonary exacerbations. *Am J Respir Crit Care Med* 2009; 180: 802–808.

HERMES Syllabus link: 6 Airway diseases, 7 Respiratory infections, 26 Genetic and developmental disorders
Angoff rating: 52%

Question 23

A 52-year-old woman known for poorly controlled asthma is referred to the emergency unit with acute dyspnoea. On her chest X-ray, multiple infiltrates are seen on both lungs, prominently on the lower parts. She also complains of weakness of her left arm and numbness of several fingertips on both hands. Her urine is microscopically positive for red blood cells. Purpura is seen on her right forearm and on her right ankle. Due to increasing dyspnoea despite bronchodilators, the patient is referred to the intensive care unit.
Which of the following statements regarding the confirmation or rejection of the suspected diagnosis is most appropriate?

a. A negative test for cytoplasmic anti-neutrophil cytoplasmic antibody (proteinase 3) would render it improbable.
b. >10% eosinophils in the white blood cell count and elevated IgE would support it.
c. A positive test for Jo-1 antibodies would support it.
d. A positive skin-prick test for *Aspergillus* would support it
e. A positive test for neuron-specific enolase would support it.

Correct answer

b. >10% eosinophils in the white blood cell count and elevated IgE would support it.

Eosinophilic granulomatosis with polyangiitis (EGPA), formerly called Churg–Strauss syndrome, is part of the group of anti-neutrophil cytoplasmic antibody (ANCA)-associated vasculitic diseases. It is characterised by late-onset asthma, hypereosinophilia, and systemic necrotising vasculitis of the small and middle-sized arteries with necrotising granuloma of the vessel walls and extravascular tissue. Peripheral blood eosinophils >10% are a hallmark of this disease. Apart from nonspecific symptoms such as weight loss and fever, different organ systems may be affected. Asthma occurs in 95–100%, the upper airways are affected with rhinosinusitis and polyps, and the lung parenchyma may be affected. Mononeuritis multiplex, cutaneous manifestations, and cardiac, gastrointestinal, renal and central nervous affections may occur during the vasculitic phase. Myalgia may also occur in this phase. After the first description of EGPA in 1951, criteria were defined to allow for a diagnosis in the absence of a histological proof, which is often difficult to make. Thus, if four out of six of the American College of Rheumatology criteria are fulfilled, the sensitivity and specificity for EGPA are 85% and 99.7%, respectively. ANCA against myeloperoxidase (perinuclear ANCA) are positive in only 40–70% of cases; thus, a negative test cannot rule out EGPA. ANCA against proteinase 3 are more likely to be positive in EGPA. Antisynthetase antibodies (anti-aminoacyl transfer RNA antibodies (Jo-1)) may be elevated in idiopathic anti-inflammatory diseases with arthritis, myopathy and Raynaud's syndrome that can be associated with interstitial lung disease. A positive skin-prick test for *Aspergillus* would be a marker of allergic bronchopulmonary aspergillosis, not EGPA. Neuron-specific enolase is an immunohistochemical marker that occurs in neuroendocrine tumours such as carcinoids and small cell lung cancer.

References

Frankel SK, *et al.* The pulmonary vasculitides. *Am Respir Crit Care Med* 2012; 186: 216–224.

Mouthon L, *et al.* Diagnosis and classification of eosinophilic granulomatosis with polyangiitis (formerly named Churg–Strauss syndrome). *J Autoimmun* 2014; 48–49: 99–103.

Lally L, *et al.* Pulmonary vasculitis. *Rheum Dis Clin North Am* 2015; 41: 315–331.

HERMES Syllabus link: 12 Eosinophilic diseases, 14 Pulmonary vascular diseases
Angoff rating: 52%

Question 24

Which of the following is/are true in pleural effusions?

a. Low pleural fluid glucose (<3.4 mmol · L^{-1}) is specific for a complicated parapneumonic effusion.
b. A complicated parapneumonic effusion by *Proteus* spp. may present with pH >7.5.
c. Small parapneumonic effusions (*e.g.* <10 mm thickness) may not require thoracentesis.
d. A positive Gram stain in a parapneumonic effusion indicates the need for chest tube drainage.

Correct answers

b. A complicated parapneumonic effusion by *Proteus* spp. may present with pH >7.5.
c. Small parapneumonic effusions (*e.g.* <10 mm thickness) may not require thoracentesis.
d. A positive Gram stain in a parapneumonic effusion indicates the need for chest tube drainage.

A parapneumonic effusion is a pleural fluid collection adjacent to a pneumonia. A small parapneumonic effusion that does not require particular treatment other than antibiotics is called a simple uncomplicated parapneumonic effusion. If bacteria and inflammatory cells invade the pleural space, the pH becomes acidotic, glucose levels decrease (often to values <2.2 $mmol \cdot L^{-1}$) and lysis of neutrophils results in increased levels of lactate dehydrogenase (>1000 $U \cdot L^{-1}$ or >0.5 times the value in the serum). In this condition, pleural drainage is usually required. Bacteria seen in the Gram stain of a pleural effusion confirm infection of the pleural space and this usually indicates empyema requiring drainage or even a surgical intervention. This indication for chest tube drainage is often based on the presence of frank pus (indicating empyema) or a low pH of the pleural fluid (<7.2), suggesting a complicated parapneumonic effusion. A low pleural fluid pH and glucose concentration are not specific to parapneumonic effusions but may also be present in effusions from other causes (*e.g.* rheumatoid arthritis). A parapneumonic effusion from *Proteus* spp. may be alkalotic due to the production of ammonia from urea hydrolysis.

Reference

Davies HE, *et al.* Management of pleural infection in adults: British Thoracic Society pleural disease guideline 2010. *Thorax* 2010; 65: Suppl. 2, ii41–ii53.

HERMES Syllabus link: 7 Respiratory infections, 20 Pleural diseases
Angoff rating: 54%

Question 25

A 25-year-old woman has had nearly continuous daytime sleepiness for 6 years. She either falls asleep or 'blacks out' involuntarily several times a day, especially in business meetings, and has to be awakened by colleagues. She has frequent nocturnal awakenings, sometimes associated with nightmares. She has been told that she snores, although she now lives alone. A review of her symptoms is remarkable for a several-year history of almost daily 'collapsing' spells, lasting 20–30 s, during which she feels her knees buckle, requiring her to sit for a few minutes. She is 152 cm tall, weighs 70 kg, has a neck circumference of 43 cm, a blood pressure of 100/72 mmHg and an otherwise normal physical examination.
What is the most appropriate next step?

a. Polysomnography
b. Polysomnography followed by a multiple sleep latency test
c. Oververnight screening pulse oximetry
d. Periodic office follow-up, and advice to avoid or eliminate obesity, sleep deprivation, and bedtime alcohol or sedative intake
e. Diagnostic psychiatric evaluation

Correct answer

b. Polysomnography followed by a multiple sleep latency test

OSAS and narcolepsy are the most relevant differential diagnoses for this case. Daytime sleepiness is common in both diseases. Frequent awakening and snoring, as well as the high body weight (BMI 30 $kg \cdot m^{-2}$) and neck circumference could indicate OSAS. However, narcolepsy is characterised by irresistible sleep attacks during the day, often at inappropriate times. Moreover, it presents with typical symptoms of cataplexy with transient muscle weakness, which may be triggered by emotions. The diagnostic evaluation includes polysomnography in order to diagnose breathing disturbances during the night and the sleep profile. The typical finding of narcolepsy is sleep-onset rapid eye movement (SOREM), which is not only measured during polysomnography but also in multiple sleep latency tests (MSLTs). In persons with symptoms suggestive of narcolepsy, including excessive sleepiness and cataplexy, the diagnosis is supported by a mean sleep latency in the MSLT of ≤8 min and two or more SOREM periods.

References

American Academy of Sleep Medicine. International Classification of Sleep Disorders. 3rd Edn. Westchester, AASM, 2014.

Morgenthaler TI, *et al.* Practice parameters for the treatment of narcolepsy and other hypersomnias of central origin. *Sleep* 2007; 30: 1705–1711.

Littner MR, *et al.* Practice parameters for clinical use of the multiple sleep latency test and the maintenance of wakefulness test. *Sleep* 2005; 28: 113–121.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 71%

Question 26

A 64-year-old male with stable COPD (FEV_1 25% predicted) is offered a pulmonary rehabilitation (PR) course immediately after discharge from hospital following an acute exacerbation of COPD. His medical therapy has been optimised, but he is breathless on walking 200 m. The patient is sceptical about participating in the PR course.
In explaining the potential benefits to the patient, which one of the statements below is evidence based?
Pulmonary rehabilitation in COPD has been shown to improve exercise tolerance and:

a. Reduce the need for long-term oxygen therapy
b. Reduce the risk of hospital admission for a further exacerbation of COPD
c. Reduce the risk of myocardial infarction and stroke
d. Reduce mortality from COPD
e. Increase FEV_1

Correct answer

b. Reduce the risk of hospital admission for a further exacerbation of COPD

Pulmonary rehabilitation (PR) is an evidence-based multidisciplinary and comprehensive intervention for patients with chronic respiratory disease who are symptomatic despite optimal medical therapy. Guidelines developed by ACCP/AACVPR indicate a strong (1A) recommendation that PR will improve health-related quality of life and decrease dyspnoea. There is no consistent evidence that PR reduces mortality in COPD. A randomised controlled trial has shown that PR starting within 10 days of hospital discharge following an acute exacerbation of COPD reduced admission rate for acute exacerbations within the subsequent 3 months compared with the group receiving usual care without PR. A recent systematic review and meta-analysis has shown a mild beneficial effect of multidisciplinary PR on mood.

References

Coventry PA, *et al.* Comprehensive pulmonary rehabilitation for anxiety and depression in adults with chronic obstructive pulmonary disease: systematic review and meta-analysis. *J Psychom Res* 2007; 63: 551–565.

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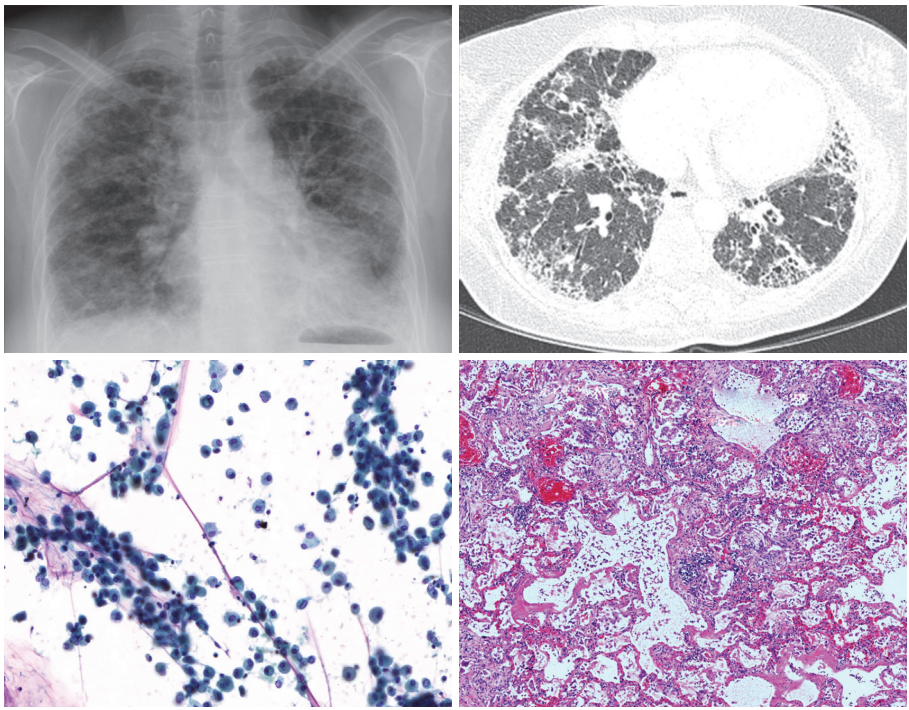
Seymour JM, *et al.* Outpatient pulmonary rehabilitation following acute exacerbations of COPD. *Thorax* 2010; 65: 423–428.

Troosters T, *et al.* Pulmonary rehabilitation. *In*: Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, Sheffield 2013; pp. 543–551.

HERMES Syllabus link: 6 Airway diseases
Angoff rating: 58%

Question 27

A 38-year-old nonsmoking and otherwise healthy farmer complains of increasing cough and dyspnoea on exertion of almost 3 years' duration. Due to acute clinical worsening with dyspnoea even at rest and hypoxaemia (SpO_2 of 88% on room air), the patient was admitted to the emergency department. There were no clinical and laboratory signs of infection. Pulmonary function testing was not feasible. A chest radiograph and CT were obtained. A bronchoscopy with a bronchoalveolar lavage was performed. It revealed a predominance of lymphocytes and only occasional eosinophils and macrophages. Open-lung biopsy findings are shown.



Which one of the following is the most likely diagnosis?

a. Langerhans' cell histiocytosis
b. Idiopathic pulmonary fibrosis
c. Hypersensitivity pneumonitis
d. Desquamative interstitial pneumonitis
e. Acute eosinophilic pneumonia

Correct answer

c. Hypersensitivity pneumonitis

The description best fits a patient with very advanced chronic hypersensitivity pneumonitis (extrinsic allergic alveolitis). Hypersensitivity pneumonitis is an immunologically mediated inflammatory lung disease (type III allergy) in the lung parenchyma induced by the inhalation of a variety of antigens. The main characteristic is a massive lymphocytic inflammation (activated T-lymphocytes) in the lung interstitium, visible in bronchoalveolar lavage (BAL) fluid and lung biopsy (see figure). The diagnosis relies on an array of nonspecific symptoms and signs developed in an appropriate setting with demonstration of bilateral nodular or patchy infiltrates. On an early stage, chest radiography shows fine nodular shadows, either diffuse or predominantly in the bases. Here, an advanced stage with progressive fibrosis is shown, as the diagnosis has been missed for years. The patient was a bird-fancier. At this stage of disease in Langerhans cell histiocytosis (histiocytosis X), one would expect the presence of cysts. Ill-defined nodules would also be a feature of Langerhans cell histiocytosis. As the patient was a nonsmoker, this disease is unlikely. Moreover, BAL would demonstrate predominantly macrophages, sometimes with a slight increase in eosinophils and Langerhans cells. Idiopathic pulmonary fibrosis (IPF) with the histologic pattern of usual interstitial pneumonitis (UIP) typically develops in patients aged >50 years. The main radiological feature is honeycombing; secondary features include reticular opacities, thickened bronchial walls, bronchiectasis and bronchioloectasis. BAL would not show predominant lymphocytes. Desquamative interstitial pneumonitis (DIP) is characterised by insidious onset with a worsening dry cough and progressive dyspnoea. There is a strong association between this disease and cigarette smoking. Radiological signs include ground-glass opacities with a lower zone predilection. Histologically, intra-alveolar macrophage accumulation and the presence of hyperplastic epithelial cells are predominant. Acute eosinophilic pneumonia presents as an acute febrile illness of <5 days' duration. The chest radiograph demonstrates diffuse alveolar and interstitial infiltrates. The diagnosis is confirmed by the presence of BAL eosinophilia >25% in the absence of other explanations for eosinophilia, such as parasites.

References

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Cordier J-F, *et al*. Adult pulmonary Langerhans cell histiocytosis. *In:* Palange P, *et al*., eds. ERS Handbook of Respiratory Medicine 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 532–534.

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Sigsgaard T, *et al*. Hypersensitivity pneumonitis. *In:* Palange P, *et al*., eds. ERS Handbook of Respiratory Medicine 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 337–340.

HERMES Syllabus link: 10 Interstitial lung diseases
Angoff rating: 55%

Question 28

A 68-year-old male is admitted to the emergency room complaining about shortness of breath, fever, chills and cough with purulent sputum production for the last 2 days. He is a nonsmoker without any previous medical history. The patient looks tired but other than that he is in good condition without any confusion. Vital signs are blood pressure 105/70 mmHg, heart rate 110 beats per min, breathing rate 32 breaths per min, and temperature 38.9 °C. Bronchial breath sounds are heard on auscultation of the right chest. Blood tests reveal a white blood cell count of 9000×10^9 per L with a left shift, haematocrit 46%, urea 22 mmol·L^{-1}, creatinine 160 µmol·L^{-1}, sodium 142 mmol·L^{-1} and oxygen saturation (room air) 92%. A chest radiograph demonstrates moderate cardiomegaly and a right lower lobe infiltrate with air bronchograms.
Which one of the following is the appropriate management decision for this patient?

a. Treat as an outpatient, start empirical antibiotic therapy without further examinations
b. Treat as an outpatient, take blood and sputum cultures, start empirical antibiotic therapy
c. Admit to hospital, start empirical antibiotic therapy within 4 h of admission
d. Admit to hospital, take blood and sputum cultures and Gram stains, start antibiotic therapy according to results
e. Treat in the intensive care unit, start empirical antibiotic therapy

Correct answer

c. Admit to hospital, start empirical antibiotic therapy within 4 h of admission

Pneumonia is a condition caused by microbial infection within the lung parenchyma. Pneumonia is classified according to the origin as community-acquired (CAP) or hospital-acquired (nosocomial pneumonia (NP)). According to the definition, CAP occurs in the absence of immune compromise or prior hospital admission within the previous 7 days. The decision regarding the most appropriate site of care, including whether hospitalisation of a patient with CAP is warranted, is the first and single most important decision in the overall management of CAP. This decision is best performed by an accurate assessment of the severity of illness at presentation and the likely prognosis. Clinical assessment of disease severity is dependent on the experience of the attending clinician but such clinical judgement has been shown to result in apparent underestimation of severity. Therefore, various severity scoring systems and predictive models have been developed in an attempt to help the clinician identify patients with pneumonia and a poor prognosis at an early stage. The six-point CURB-65 score, one point for each of confusion, urea >7 $mmol \cdot L^{-1}$, respiratory rate >30 breaths per min, low systolic (<90 mmHg) or diastolic (≤60 mmHg) blood pressure and age >65 years, is based on information available at initial hospital assessment and enables patients to be stratified according to increasing risk of mortality (score 0: 0.7%; score 1: 2.1%; score 2: 9.2%; and scores 3–5: 15–40%). Patients who have a CURB-65 score of 3 or more (as the patient in this question, with a CURB-65 score of 3) are at high risk of death. These patients require urgent hospital admission. Patients with CURB-65 scores of 4 and 5 should be assessed with specific consideration to the need for transfer to a critical care unit (high dependency unit or intensive care unit). Microbiological tests (blood and sputum cultures) are recommended in patients with moderate and high severity CAP admitted to the hospital. All patients should receive antibiotics as soon as the diagnosis of CAP is confirmed. The objective for any service should be to confirm a diagnosis of pneumonia with chest radiography and initiate empirical antibiotic therapy within 4 h of presentation to the hospital.

References

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Woodhead M. Pneumonia. *In*: Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 199–202.

HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 50%

Question 29

A patient on mechanical ventilation for acute respiratory distress syndrome develops a right-sided pneumothorax.
Which of the following measures should be taken at this time?

a. Pleural puncture and aspiration of the pleural air
b. Double-lumen intubation and reduction of positive end-expiratory pressure
c. Insertion of a small-bore chest tube
d. Surgical closure of the leak by video-assisted thoracoscopic surgery
e. Increase in inspiratory oxygen fraction by 10%

Correct answer

c. Insertion of a small-bore chest tube

Positive pressure ventilation carries an elevated risk of barotrauma. The rupture of the alveolar wall due to increased transpulmonary pressure results in air leakage that causes either a pneumothorax or a pneumomediastinum. Acute respiratory distress syndrome is known to be an independent risk factor for pulmonary barotrauma. If pneumothorax develops in patients on positive pressure mechanical ventilation, it may rapidly progress to a tension pneumothorax, causing cardiovascular failure; therefore, pneumothorax should be alleviated promptly after its discovery. The recommended practice is the insertion of a chest tube for pneumothorax developing during mechanical ventilation because of the risk of the development of a tension pneumothorax. The general consensus recommends a small-bore chest tube as the first choice because it works well and with fewer complications than large-bore tubes. Manual aspiration with thoracentesis has not been studied in intensive care setting and is not recommended because it does not allow continuous drainage of the air leak. If persistent air leakage is observed for 3–5 days, surgical intervention should be considered. Video-assisted thoracoscopic surgery is preferred to open thoracotomy based on a non-evidence-based Delphi consensus statement in the American College of Chest Physicians guideline. Increasing the inspiratory oxygen fraction and decreasing the positive end-expiratory pressure may slow down the further development of the pneumothorax but are insufficient measures to prevent a tension pneumothorax.

References

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HERMES Syllabus link: 18 Respiratory failure, 20 Pleural diseases, 27 Associated specialties
Angoff rating: 64%

Question 30

A 45-year-old banker complains of dyspnoea when he climbs the stairs to his office on the third floor. When he reaches the second floor, his chest feels tight and several times he has almost fainted so that he had to sit down until he recovered. 5 years ago, he fractured his right ankle at a golf tournament. The fracture was complicated by a deep vein thrombosis of the right leg with concomitant pulmonary embolism. On lung function testing, lung volumes are normal and T_{LCO} is 35% predicted. S_{pO_2} on room air is 86%, and arterial blood gas analysis reveals a P_{aO_2} of 7.6 kPa (57 mmHg), P_{aCO_2} of 4.0 kPa (30 mmHg) and pH of 7.47. Echocardiography shows a normally functioning left ventricle; the right ventricle is dilated and the systolic pulmonary pressure is estimated to be 50 mmHg.
Which of the following is the next appropriate step in the management of this patient?

a. MRI angiogram (angio-MRI) of the chest
b. Pulmonary angiography combined with right-heart catheterisation
c. Start therapy with prostacycline
d. Coronary angiography
e. Start therapy with sildenafil

Correct answer

b. Pulmonary angiography combined with right-heart catheterisation

The patient suffers from chronic thromboembolic pulmonary hypertension (CTEPH) after pulmonary embolism 5 years ago. Pulmonary angiography should be performed to evaluate the patient for surgical thrombendarterectomy of the pulmonary arteries. Pulmonary angiography combined with right-heart catheterisation remains the reference standard for the diagnosis and determination of surgical accessibility of CTEPH. Therapies with prostacycline and sildenafil are second line, either after partial successful surgical thrombendarterectomy or if thrombendarterectomy cannot be performed.

Reference

Fedullo P, *et al.* Chronic thromboembolic pulmonary hypertension. *Am J Respir Crit Care Med* 2011; 183: 1605–1613.

HERMES Syllabus link: 14 Pulmonary vascular diseases
Angoff rating: 57%

Question 31

A 48-year-old female with a 25 pack-year history of smoking presents with fever, cough and purulent sputum production and her chest radiograph shows consolidation of the right middle lobe. She has a history compatible with chronic bronchitis but normal spirometry and she had a bronchitis exacerbation 2 months ago for which she received treatment with moxifloxacin. Her blood pressure is 115/75 mmHg, her breathing rate is 18 breaths per min. She does not look severely ill but she is depressed and tired because she has spent long hours with her mother who was at a home for the elderly and died a week ago, 2 weeks after acquiring an influenza infection. The patient is anxious to get well soon and return to work because she has already taken a long time off.
Which one of the following is the appropriate treatment for this patient?

a. Amoxicillin-clavulanate and macrolide
b. Oseltamivir
c. Moxifloxacin
d. Piperacillin-tazobactam and ciprofloxacin
e. Acyclovir and amoxicillin-clavulanate

Correct answer

a. Amoxicillin-clavulanate and macrolide.

The patient has been exposed to a hospice environment and therefore this is healthcare-related pneumonia. Her pneumonia involves one lobe only, the patient is not severely ill and has no increased risk, so, according to the guidelines, she can be treated with an aminopenicillin plus β-lactamase inhibitor, a second generation cephalosporin or a respiratory quinolone. This patient has had treatment with a quinolone less than 3 months ago and she should not be treated with moxifloxacin. She has been exposed to influenza but that was more than 2 weeks ago and, therefore, this is too long for her to develop influenza. Aciclovir is used for the treatment of herpes infections and therefore is not indicated here. Piperacillin-tazobactam and ciprofloxacin are indicated for healthcare-related pneumonia but when risk factors for multi-drug resistance are suspected or after a long hospitalisation. Amoxicillin-clavulanate and macrolide is appropriate as this treatment covers streptococcal infection which is still very probable.

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HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 60%

Question 32

A 35-year-old English female with a 3-month history of lethargy and increasing dyspnoea went on holiday to Mallorca, Spain, where she became unwell with nausea, vomiting, polyuria and confusion. A chest radiograph showed diffuse reticular opacities of the lung with bilateral hilar lymphadenopathy.
Which one of the following investigations would be most useful in guiding her acute management?

a. Serum calcium
b. Serum angiotensin-converting enzyme
c. Serum amylase
d. Chest CT
e. Head MRI

Correct answer

a. Serum calcium

The chest radiograph suggests a diagnosis of sarcoidosis and the history indicates active disease. The acute symptomatology is consistent with hypercalcaemia, which is likely to have developed because of exposure to sunlight on holiday. Hypercalcaemia is known to complicate sarcoidosis and other granulomatous diseases, such as tuberculosis. The defect in calcium metabolism is due to extrarenal production of calcitriol by activated macrophages. Serum angiotensin-converting enzyme level may support the diagnosis of sarcoidosis but would not help acute management. Serum amylase may indicate pancreatitis, which may occur in hypercalcaemia, but the symptoms in this case do not suggest pancreatitis. Chest CT may better define the extent of the sarcoidosis but would not contribute to the acute problem. Head MRI may indicate neurosarcoidosis but the history does not suggest that.
Management of hypercalcaemia in sarcoidosis involves reducing calcium intake (≤400 $mg \cdot day^{-1}$), reducing oxalate intake, eliminating dietary vitamin D supplements and avoiding sun exposure. Intravenous fluid administration to correct dehydration and loop diuretics (*e.g.* furosemide) promote renal excretion of calcium. The use of corticosteroids in granulomatous diseases is thought to be beneficial through inhibition of 1-α-hydroxylase in activated macrophages.

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HERMES Syllabus link: 10 Interstitial lung disease
Angoff rating: 42%

Question 33

A 22-year-old patient with Duchenne muscular dystrophy is ventilated at home with a bilevel pressure-cycled ventilator. Following a lower airway infection, he experiences great difficulty in clearing bronchial secretions.
Of the following treatments, which one is recommended in this case?

a. Increasing ventilator inspiratory positive airway pressure
b. Regular use of an oral mucolytic agent
c. Regular use of nebulised 3% saline
d. Bronchial secretion clearance with mechanical insufflation–exsufflation
e. Suction of pharyngeal secretions

Correct answer

d. Bronchial secretion clearance with mechanical insufflation–exsufflation

Duchenne muscular dystrophy is characterised by inspiratory and expiratory muscle weakness. During a chest infection, secretions are difficult to clear because of ineffective coughing. While increasing inspiratory airway pressure on a bilevel pressure-cycled ventilator may improve control of ventilatory failure, and the use of nebulised saline and a mucolytic agent may improve sputum rheology, the use of suction in the upper airway and mouth will not clear lower airway secretions. The cough insufflator–exsufflator augments peak cough flow and is the most effective way of clearing secretions. The combination of NIV and cough insufflator–exsufflation reduces pulmonary morbidity, and may decrease the need for tracheostomy.

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HERMES Syllabus link: 18 Respiratory failure, 19 Diseases of the chest wall and respiratory muscles including the diaphragm
Angoff rating: 62%

Question 34

Which of the following radiographic features is least likely to be found in Langerhans' cell histiocytosis of the lung?

a. Diffuse nodules ranging in size up to 10 mm
b. Diffuse reticulonodular opacities
c. Pneumothorax
d. Pleural effusion
e. Honeycomb lung

Correct answer

d. Pleural effusion

Langerhans' cell histiocytosis (LCH) of the lung is characterised by stellate nodules (2–10 mm in size) and reticular and nodular opacities with a predominantly bilateral symmetric upper- to mid-lung distribution; the costophrenic angles are usually spared (see figure). When the disease progresses, cysts develop and may become the dominant imaging finding. Cysts vary in size but usually are smaller than 1 cm. A confluence of cysts may result in bullous formation, which then predisposes the patient to recurrent spontaneous pneumothorax. In advanced LCH, honeycomb changes can occur. Pleural effusions are rare findings.

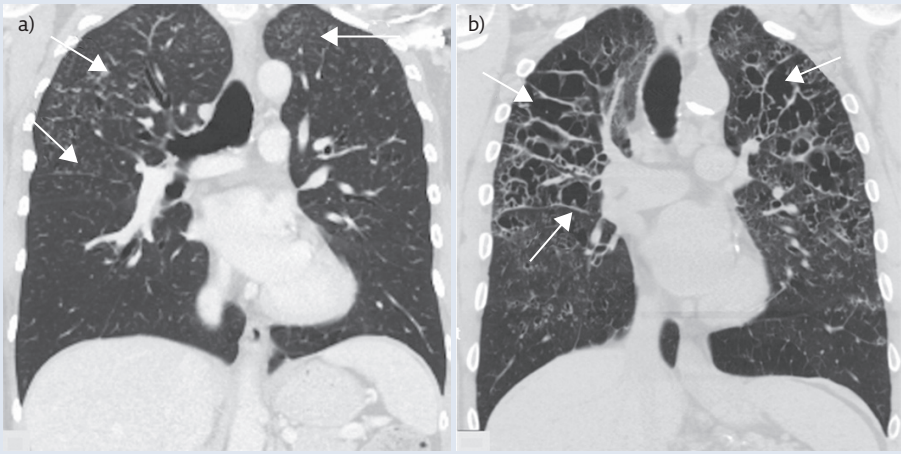

FIGURE Lung involvement in Langerhans' cell histiocytosis. a) Coronal CT image shows centrilobular nodules (arrows) with a predominantly upper-lobe distribution. The lack of cysts suggests early-onset disease. b) The coronal CT image in a different patient shows numerous bilateral upper-lobe-predominant cysts of varying sizes (arrows). Note the sparing of the costophrenic angles in both patients, a characteristic imaging feature. Reproduced from Zaveri *et al*. (2014) with permission from the publisher.

Reference

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HERMES Syllabus link: 25 Orphan and rare lung diseases
Angoff rating: 63%

Question 35

A 46-year-old nonsmoking patient suffers from recurrent purulent bronchitis. He complains of increased sputum production but is otherwise well. A CT scan shows bilateral, mainly lower lobe tubular bronchiectasis.
Which of the following investigation(s) is/are important for treatment decisions?

a. Search for nontuberculous mycobacteria in sputum
b. α_1-antitrypsin serum level
c. IgG and subclasses levels in serum
d. Bacterial sputum cultures

Correct answers

a. Search for nontuberculous mycobacteria in sputum
c. IgG and subclasses levels in serum
d. Bacterial sputum cultures

Risk factors for nontuberculous mycobacteria (NTM) infections include chronic lung diseases, such as bronchiectasis and COPD, and various forms of immunodeficiency. When NTM are inhaled by susceptible individuals, infection can lead to a chronic progressive and sometimes fatal lung disease.

α_1-antitrypsin (AAT) deficiency is classically associated with predominantly lower lobe emphysema. Bronchiectasis has also been associated with the enzyme deficiency. Whether this is a direct consequence of the deficiency or secondary to the emphysema-associated airway obstruction is not clear. In a study of patients with severe AAT-deficiency, the vast majority of subjects had some evidence of bronchiectasis on a high-resolution CT scan (70 out of 74 subjects). However, AAT augmentation therapy is not indicated in the described patient. Although it has been demonstrated to slow the progression of emphysema in CT studies AAT augmentation has no role in the therapy of bronchiectasis.

Immunodeficiencies may predispose to bronchiectasis. The immune defects most strongly associated with bronchiectasis are those resulting in hypogammaglobulinaemia. These include the primary immunodeficiencies, common variable immunodeficiency and X-linked agammaglobulinaemia and the secondary immunodeficiencies caused by lymphoproliferative malignancy, allogeneic bone marrow transplantation and chemo-immunotherapy. Conditions resulting in T-cell dysfunction *e.g.* HIV infection or immunosuppression, reduced bacterial opsonisation, complement deficiencies, failure of phagocyte migration (leukocyte adhesion deficiency) and impaired intracellular killing of bacteria (chronic granulomatous disease) may also predispose to bronchiectasis.

Sputum microbiology is a key investigation tool in the diagnosis of patients with bronchiectasis. *Haemophilus influenzae* is the most frequently isolated pathogen and found in up to 35% of patients. *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Moraxella catarrhalis* and *Pseudomonas aeruginosa* are also commonly identified. *Aspergillus* sp. may also be found and may be associated with allergic bronchopulmonary aspergillosis. The presence of *P. aeruginosa* in sputum from patients with bronchiectasis is associated with more severe lung disease and may also indicate a worse prognosis.

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HERMES Syllabus link: 6 Airway diseases, 26 Genetic and developmental disorders, 24 Immunodeficiency disorders
Angoff rating: 55%

Question 36

A 55-year-old secretary has been diagnosed with OSAS based on excessive sleepiness (Epworth sleepiness score 14) with frequent episodes of dozing off at work, habitual snoring and an AHI of 36 events per h during polysomnography. Her BMI is 29.3 $kg \cdot m^{-2}$ and her blood pressure is 125/75 mmHg. Oral inspection reveals a Mallampati score of I with normal tonsillar size and normal teeth. There is a deviation of the nasal septum to the right and she seems to breathe predominantly through the left side of the nose. Treatment with nasal CPAP is explained and recommended to the patient. However, she declares that she would under no circumstances use any treatment that required wearing a mask.
Which one of the following treatments is the most effective alternative treatment modality for this patient?

a. Surgical correction of nasal septum deviation
b. Uvulopalatopharyngoplasty
c. Sleep hygiene and weight loss
d. A mandibular advancement device
e. Laser-assisted uvulopalatoplasty

Correct answer

d. A mandibular advancement device.

Nocturnal application of CPAP therapy is the main treatment for OSAS. CPAP has been shown to improve symptoms including excessive sleepiness and quality of life. In addition, it lowers blood pressure in hypertensive patients and there is some evidence that the risk of traffic accidents might also be reduced. However, certain patients are unable or unwilling to use CPAP and require an alternative treatment. Sleep hygiene (*i.e.* regular sleeping hours and sufficient sleep time), avoidance of alcohol in the evening and smoking cessation are commonly recommended as adjuncts to CPAP, but these measures alone have little effect on nocturnal breathing disturbances. In a randomised study in patients with mild-to-moderate OSA, the effectiveness of sleep hygiene and recommended weight reduction alone or combined with either a mandibular advancement device or CPAP were evaluated. Mandibular advancement devices were significantly more effective in improving quality of life domains and the AHI. Several other randomised, sham-controlled studies confirm that mandibular advancement devices improve sleep disordered breathing, daytime sleepiness, quality of life and objective vigilance, and reduce blood pressure in OSA patients. In patients with severe OSA, mandibular advancement devices may not perfectly control sleep-related breathing disturbances but are superior to no treatment at all.

Although uvulopalatopharyngoplasty (UPPP) has been performed for many years for snoring and OSA, there is no evidence from randomised studies that supports its effectiveness. In one study randomising OSA patients to either treatment with a mandibular advancement device or UPPP, control of sleep apnoea was superior in the group receiving a mandibular advancement device at 1 and 4 yrs follow-up. A randomised sham-controlled study revealed no benefit of laser-assisted uvulopalatoplasty compared with a sham operation. Since there are no studies indicating a clear benefit of UPPP or laser-assisted uvulopalatoplasty, these procedures are not recommended as treatments for OSA. Although nasal obstruction may promote snoring and disturb sleep, studies indicate that treating nasal obstruction with nasal decongestants, topical steroids or surgery have very little effect on sleep-related breathing disturbances in OSA patients. Nevertheless, these treatments may be of some use as adjuncts to CPAP therapy or mandibular advancement devices.

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HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 56%

Question 37

A 66-year-old Dutch woman presents with 3 weeks of cough and sputum production, with haemoptysis and 2.3 kg weight loss in 1 month. She has a history of multiple episodes of childhood pneumonia. She does not smoke but says that she has had a chronic cough for 5 years, present throughout the day, with daily sputum production. Several times a year, she receives antibiotic therapy for purulent sputum. Her tuberculin skin test was positive 20 years ago. Chest radiography shows increased markings at the lung bases with 'tramlines' and dilated bronchial shadows. Furthermore, an infiltrate with a 1-cm thin-walled cavity in the right upper lobe is seen. A sputum smear for acid-fast bacilli is positive.
Which of the following should be the next step in the management of this patient?

a. Start therapy with isoniazid, rifampicin and ethambutol.
b. Collect two additional sputum samples, and start therapy with isoniazid, rifampicin, ethambutol and pyrazinamide.
c. Collect two additional sputum samples for mycobacterial smears and culture, then start therapy with rifampicin, ethambutol and clarithromycin.
d. Collect three additional sputum samples for mycobacterial smears and culture, then await results before starting therapy.
e. Perform bronchoscopy with transbronchial biopsy before starting therapy.

Correct answer

b. Collect two additional sputum samples, and start therapy with isoniazid, rifampicin, ethambutol and pyrazinamide.

The patient's history and chest radiography suggest that she has bronchiectasis, probably due to recurrent bacterial bronchial infections during childhood. Furthermore, she had latent tuberculosis in the past, as evidenced by her positive tuberculin skin test 20 years ago. She also has a thin-walled cavity in her right upper lobe, a sputum smear showing acid-fast bacilli, and a recent history of coughing with sputum production and considerable weight loss. These findings are suggestive of tuberculosis.

A differential diagnostic consideration should be a nontuberculous mycobacterial (NTM) infection. In light of this, additional sputum cultures should be collected (in total, at least three sputum samples should be collected, one of which is a morning sample) and then treatment against tuberculosis should be initiated. This treatment should be adjusted if the results of the definitive sputum cultures and resistance patterns warrant this.

A rapid diagnostic test for resistance patterns might be performed if available, particularly in a setting with a high likelihood of resistance. This is not the case for this patient.

If tuberculosis is suspected, therapy with isoniazid, rifampicin, pyrazinamide and ethambutol should be initiated. Furthermore, at least two additional sputum samples should be collected.

In the case of possible active tuberculosis, one should not wait until the results of the definitive cultures are available, as this may take several weeks. A transbronchial biopsy is not necessary to diagnose an active tuberculosis or NTM infection in this case.

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HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 72%

Question 38

A 60-year-old female is referred to you because of a subpleural noncalcified solitary nodule with sharp borders and a diameter of 7 mm in her right lower lobe. The nodule was detected on an abdominal CT performed to evaluate abdominal pain. Endoscopy revealed a duodenal ulcer as cause of the abdominal pain. The patient does not have any respiratory complaints. She stopped smoking 30 years ago after an exposure of approximately 15 cigarettes per day for 15 years.
What is the most appropriate next step?

a. Bronchoscopy with transbronchial biopsy
b. Positron emission tomography
c. No follow-up needed
d. Thoracoscopic resection of the nodule
e. Follow-up CT in 3–6 months

Correct answer

e. Follow-up CT in 3–6 months.

According to the Fleischner Society criteria, nodules such as the one described (7 mm in diameter) are supposed to be followed up after 3–6 months in high-risk patients. High-risk patients are defined as patients with a history of smoking or other known risk factors. If there is no change in the follow-up scan there should be repeated scans at 9–12 months and at 24 months (see table below).

Table Recommendations for follow-up and management nodules smaller than 8 mm detected incidentally at nonscreening CT

Nodule size mm[#]	Low-risk patient[¶]	High-risk patient[+]
≤4	No follow-up needed[§]	Follow-up CT at 12 months; if unchanged, no further follow-up[f]
>4–6	Follow-up CT at 12 months; if unchanged, no further follow-up[f]	Initial follow-up CT at 6–12 months then at 18–24 months if no change[f]
>6–8	Initial follow-up CT at 6–12 months then at 18–24 months if no change	Initial follow-up CT at 3–6 months then at 9–12 and 24 months if no change
>8	Follow-up CT at around 3, 9 and 24 months, dynamic contrast-enhanced CT, PET and/or biopsy	Same as for low-risk patient

[#]: average of length and width; [¶]: minimal or absent history of smoking and of other known risk factors; [+]: history of smoking or of other known risk factors; [§]: the risk of malignancy in this category (<1%) is substantially less than in baseline CT scan of an asymptomatic smoker; [f]: nonsolid (ground-glass) or partly solid nodules may require longer follow-up to exclude indolent adenocarcinoma. Reproduced from McMahon *et al.* (2005) with permission from the publisher.

References

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van Klaveren RJ, *et al.* Management of lung nodules detected by volume CT scanning. *N Engl J Med* 2009; 361: 2221–2226.

HERMES Syllabus link: 27 Associated specialties
Angoff rating: 61%

Question 39

Which of the following statements concerning β-adrenergic blockers and inhaled β-adrenergic agonists is/are correct?

a. β-blockers are contraindicated in patients with COPD.
b. Administration of inhaled short-acting β-adrenergic agonists decreases heart rate.
c. Administration of inhaled short-acting β-adrenergic agonists can lower serum potassium.
d. β-blockers increase in-hospital mortality in asthma patients with acute myocardial infarction.

Correct answer

c. Administration of inhaled short-acting β-adrenergic agonists can lower serum potassium.

β-adrenergic agonists are often used in patients with cardiovascular disease. While they should be used cautiously in patients with severe asthma, they can safely be used in COPD. Meta-analyses have shown a small but significant reduction in FEV_1 in patients with COPD on β-blockers. Large retrospective databases suggest an improvement of prognosis in patients with COPD being treated with β-blockers. Administration of inhaled short-acting β-adrenergic agonists induces tachycardia and lowers serum potassium. On chronic treatment, there is tachyphylaxis concerning these effects. The use of cardio-selective β-blockers has been shown to reduce in-hospital mortality in asthma patients after an acute coronary event.

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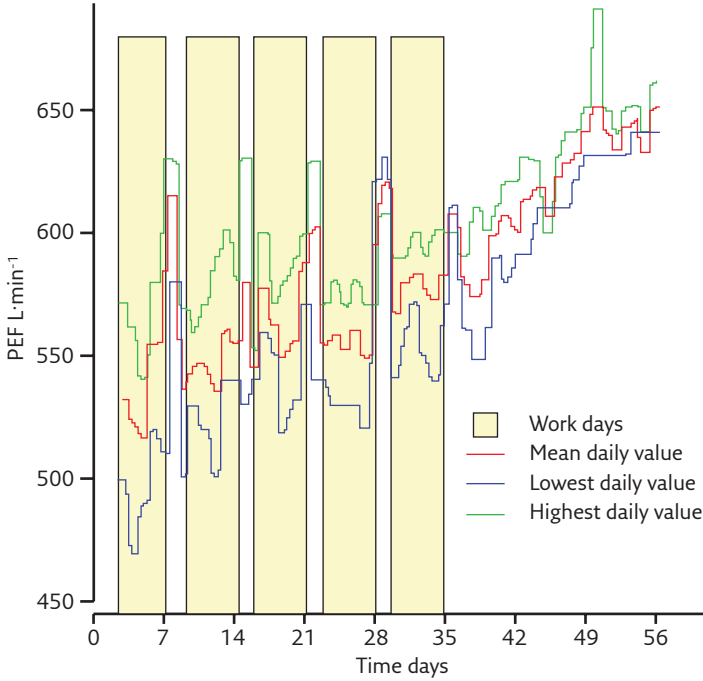
HERMES Syllabus links: 6 Airway diseases
Angoff rating: 63%

Question 40

A 23-year-old, atopic laboratory technician experiences adult-onset asthma that she attributes to handling laboratory rats. She describes an almost immediate onset of asthma symptoms after entering the work place, with some resolution during the day, but subsequently, another asthmatic attack during the early evening after she returns home from work. Her peak expiratory flow data from a 5-week period of work followed by 3 weeks of holiday are shown below.



PEF: peak expiratory flow.

Which of the following therapeutic approaches is most appropriate?

a. Immunotherapy using an allergen derived from rat urine protein
b. Complete termination of occupational exposure
c. Limiting exposure and prophylactic treatment with aerosol cromoglicic acid
d. Limiting exposure and providing a respiratory protective device
e. Improving ventilation in the work place and documenting magnitude of subsequent exposure by immunoassay

Correct answer

b. Complete termination of occupational exposure

The patient's history suggests that she has occupational asthma with a dual-phase (early and late) allergic asthmatic reaction to rat allergen. The best treatment is a complete termination of the exposure to the antigen. Limiting exposure will not result in a resolution of the asthmatic attacks for exposure to a very limited amount of allergen can already provoke allergic reactions in sensitised persons. Cromoglicic acid is not the primarily recommended prophylactic drug to be used in allergic asthma. Immunotherapy has no proven efficacy in this case. The peak flow data illustrate a marked improvement during a period of holidays.

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HERMES Syllabus link: 6 Airway diseases
Angoff rating: 63%

Question 41

A 65-year-old former smoker with COPD of Global Initiative for Chronic Obstructive Lung Disease grade 3, group D, is referred to the intensive care unit because of an acute exacerbation of his disease, presenting with increased dyspnoea and purulent sputum. Despite inhalation of salbutamol, intravenous antibiotics and corticosteroids, his condition worsens gradually over 30 min. He has not eaten or drunk for the last 5 h. On arterial blood gas analysis, pH is 7.25, P_{aO_2} is 6.6 kPa (49.5 mmHg) and P_{aCO_2} is 8.0 kPa (60 mmHg). He is agitated but cooperates with inhalation and opens his eyes on request. His respiratory rate is 26 breaths per min.
Which therapeutic option is most appropriate in this situation?

a. Start NIV and oxygen
b. Start CPAP and oxygen
c. Intubate and start mechanical ventilation
d. Add salbutamol *i.v.* and low-dose (2.5 mg) morphine *i.v.*
e. Add inhaled short-acting anticholinergic and low-dose (2.5 mg) morphine *i.v.*

Correct answer

a. Start NIV and oxygen

NIV should be used in exacerbations of COPD when pH is <7.35 and P_{aCO_2} is >6.0 kPa (>45 mmHg). Although the case presented here shows severe acidotic decompensation, a NIV trial is warranted under intensive care unit conditions, as even a failed trial of NIV leading to a delayed endotracheal intubation does not lead to higher mortality. The efficacy of NIV in treating acute exacerbations of COPD was studied in a European, randomised, multicentre study conducted in 85 COPD patients assigned to receive conventional treatment (oxygen therapy plus drugs) or NIV. The group of patients treated with NIV had fewer intubations (26% *versus* 74%, p<0.001), fewer complications (14% *versus* 45%, p<0.01), shorter length of hospital stay (23±17 *versus* 35±33 days, p<0.02) and lower mortality (9% *versus* 29%; p<0.02). CPAP has not been extensively studied in COPD exacerbations. CPAP would not actively support ventilation so hypercapnia would not be expected to improve; therefore, bilevel NIV is preferred. The other therapeutic options are not expected to correct respiratory acidosis but instead, could further add to acidosis due to the ventilatory depressant action of morphine.

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HERMES Syllabus link: 6 Airway diseases, 18 Respiratory failure, 27 Associated specialties
Angoff rating: 68%

Question 42

You see an otherwise healthy 66-year-old male with COPD complaining of shortness of breath after climbing two flights of stairs. He has no dyspnoea at rest. He expectorates greyish sputum, mainly in the morning. These symptoms have been present for the past 1–2 years. He has reduced smoking to only five cigarettes per day in recent years but has a smoking history of 30 pack-years. He is on no regular medication and has not been hospitalised in the past decade. Physical examination shows no abnormality. Post-bronchodilator spirometry shows an FEV_1 of 72% predicted and a FEV_1/FVC ratio of 61%.
Which of the following actions is/are appropriate?

a. An inhaled long-acting bronchodilator is indicated to improve symptoms.
b. An inhaled corticosteroid should be started to prevent exacerbations.
c. Since the patient has reduced smoking to only five cigarettes per day, smoking cessation will have no relevant effect on lung function decline.
d. Yearly influenza vaccination should be administered.

Correct answers

a. An inhaled long-acting bronchodilator is indicated to improve symptoms.
d. Yearly influenza vaccination should be administered.

The patient has Global Initiative for Chronic Obstructive Lung Disease (GOLD) grade 2 COPD, *i.e.* moderate COPD, without comorbidities or exacerbations, and with few symptoms. According to a combined assessment of COPD, this patient is in group A (low risk and mild symptoms). Either a short-acting bronchodilator as needed or a regular long-acting bronchodilator should be prescribed to alleviate symptoms. This can be either a β-adrenergic agonist or long-acting anticholinergic agent. Inhaled corticosteroids are recommended in symptomatic patients with COPD of GOLD grade 3 or 4, or in those with a history of at least two exacerbations in the last year (groups C and D). This does not apply to this patient. Exposure to even a moderate amount of smoke represents a trigger for ongoing airway inflammation. Therefore, complete cessation of smoking is essential to delay the progress of COPD. In COPD of grade 1–4, influenza vaccination reduces serious illness and death by about 50%. The pneumococcal polysaccharide vaccine is recommended for COPD patients by the US Centers for Disease Control and Prevention, despite insufficient data.

References

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HERMES Syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases
Angoff rating: 69%

Question 43

A 62-year-old male complains of shortness of breath on mild exertion, such as climbing one flight of stairs. He has no chest pain. The referring general practitioner reports that the patient has a long history of arterial hypertension and a previous myocardial infarction with subsequent heart failure. Accordingly, the patient is on a β-blocker, an angiotensin-converting enzyme inhibitor and a diuretic. The last echocardiogram showed a left ventricular ejection fraction of 35%. The Epworth Sleepiness Scale reveals a score of 11. His wife reports that he is snoring irregularly with intermittent pauses. The patient has a BMI of 34 $kg \cdot m^{-2}$, no signs of oedema and the lungs are clear. Spirometry reveals a vital capacity of 92% predicted and FEV_1 of 94% predicted with a normal flow–volume loop.
Which of the following is/are correct?

a. In this kind of patient, pulse oximetry can reliably distinguish between OSA and Cheyne–Stokes respiration.
b. The patient most likely suffers from moderate-to-severe OSA.
c. If polysomnography confirms moderate-to-severe OSA, CPAP has the potential to improve the ejection fraction.
d. If polysomnography shows OSA, adaptive servoventilation is the treatment of choice.

Correct answers

b. The patient most likely suffers from moderate-to-severe OSA.
c. If polysomnography confirms moderate-to-severe OSA, CPAP has the potential to improve the ejection fraction.

Patients with heart failure sleep apnoea commonly have OSA and, to a lesser extent, central sleep apnoea/Cheyne–Stokes respiration. This is especially true for male and overweight patients. Pulse oximetry cannot reliably distinguish between obstructive and central sleep apnoea. Three out of four randomised controlled trials (RCTs) showed an improvement of left ventricular function with CPAP in patients with OSAS and heart failure. The heart failure guideline of the European Society of Cardiology endorses the use of CPAP in this subset of patients (strength of recommendation IIa; strength of evidence C). Recommended initial treatment of OSAS in heart failure patients is CPAP not adaptive servoventilation (ASV) or automatic CPAP. A small proportion of patients with heart failure and OSAS will show central sleep apnoea even during 3 months of CPAP. Treatment in this setting is not established. The routine use of ASV in patients with heart failure and central sleep apnoea is not recommended at present.

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HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 53%

Question 44

A morbidly obese lorry driver (BMI 47 $kg \cdot m^{-2}$) is referred to the sleep laboratory because of excessive daytime sleepiness. The sleep study reveals an AHI of 36 events per h and the oxygen desaturation index is 30 events per h. Mean nocturnal oxygen saturation is 86% and the saturation never rises above 90% during the night. An arterial blood gas analysis reveals P_{aO_2} 7.05 kPa (53 mmHg), P_{aCO_2} 9.05 kPa (68 mmHg) and pH 7.42; bicarbonate is 34 $mmol \cdot L^{-1}$. Pulmonary function testing reveals a mild restrictive ventilatory disorder.
Which of the following would be the appropriate initial therapy for this patient?

a. Nocturnal bilevel positive airway pressure ventilation
b. Nocturnal supplemental oxygen at 2 $L \cdot min^{-1}$
c. High-flow nasal cannula oxygen therapy
d. Acetazolamide at bedtime
e. Adaptive servoventilation

Correct answer

a. Nocturnal bilevel positive airway pressure ventilation

The patient suffers from obesity hypoventilation syndrome (OHS) with a chronic compensated respiratory acidosis. OHS is defined as daytime alveolar hypoventilation (awake, sea-level P_{aCO_2} >6.0 kPa (>45 mmHg)) among patients with BMI ≥30 kg·m^{-2} in the absence of other causes of hypoventilation. 90% of OHS patients have concomitant OSA (AHI ≥5 events per h) and upper airway obstruction is the main pathophysiological component of the disease. The initial therapy for mild OHS is CPAP therapy but patients with marked hypercapnia, as in this case, will need nocturnal assisted ventilation (bilevel positive airway pressure (PAP)). Nocturnal oxygen use at 2 L·min^{-1} alone is an inadequate therapy for OHS, as it does not correct underlying hypoventilation and may worsen hypercapnia through suppression of the hypoxic ventilatory drive. A similar effect may occur with high-flow nasal oxygen therapy and there is no evidence to support the use of this in OHS. However, if desaturations persist despite bilevel PAP, supplemental oxygen should be added to the bilevel PAP during sleep to reach 90% saturation without frequent periods of >95% (to avoid hyperoxia-induced hypercapnia). Acetazolamide will stimulate the drive to breathe but will not correct the upper airway obstruction. Adaptive servoventilation is not approved for OHS. Ultimately, weight loss is the definitive treatment.

Reference

Muir J-F. Hypoventilation syndromes. *In:* Palange P *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 503–508.

HERMES Syllabus link: 18 Respiratory failure, 22 Sleep and control of breathing disorders
Angoff rating: 60%

Question 45

A 65-year-old male is admitted to the hospital because of high fever and dyspnoea associated with purulent sputum. Physical examination reveals dullness on percussion on the right lower chest and rales on auscultation. Chest radiography shows a pneumonic infiltrate in the right upper lobe and a small pleural effusion. Thoracentesis is performed.
Which of the following results of the pleural fluid analysis indicates the need for chest-tube drainage?

a. Serosanguineous appearance
b. pH <7.2
c. Glucose <60 $mmol \cdot L^{-1}$
d. Negative Gram stain
e. Lactate dehydrogenase >200 $U \cdot L^{-1}$

Correct answer

b. pH <7.2

Infection of the pleural space accompanying pneumonia leads to invasion of inflammatory cells (neutrophils) associated with acidosis, low glucose levels and high lactate dehydrogenase (LDH) levels. Parapneumonic effusions that require tube drainage are termed complicated parapneumonic effusions. The most accurate predictor of the need for chest tube drainage is a pH <7.2. A low glucose (<3.4 mmol·L^{-1}) and high LDH level (>1000 U·L^{-1}) do not improve diagnostic accuracy but may be used to assess the need for chest tube drainage if the pH cannot be measured. The glucose concentration is usually <3.4 mmol·L^{-1} if the pH is <7.2. Identification of microorganisms in the Gram stain indicates empyema requiring tube drainage. A serosanguineous appearance, a negative Gram stain, normal glucose and an only slightly elevated LDH are nonspecific and not helpful in assessing the need for tube drainage.

References

Davies HE, *et al.* Management of pleural infection in adults: British Thoracic Society pleural disease guideline 2010. *Thorax* 2010; 65: Suppl. 2, ii41–ii53.

Clive A, *et al.* Pleural infection and lung abscess. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 215–221.

HERMES Syllabus link: 7 Respiratory infections, 20 Pleural diseases
Angoff rating: 70%

Question 46

A 69-year-old, lifelong heavy smoker is assessed for exertional dyspnoea. He has a past history of hypertension and 3 years ago, he had a cerebrovascular accident with good functional recovery. Spirometry shows FEV_1 1.2 L, FVC 2.4 L, FEV_1/FVC 50%, T_{LCO} 50% predicted and oxygen saturation on room air 92%. After walking 310 m in 6 min, the patient is profoundly breathless, with Borg dyspnoea score 8 (out of 10) and oxygen saturation on room air 88%. 15 min after the exercise, repeat spirometry shows FEV_1 1.0 L, FVC 2.0 L and FEV_1/FVC 50%.
What is the <u>least</u> likely cause of the breathlessness?

a. Exercise-induced bronchoconstriction
b. Diffusion impairment
c. Dynamic hyperinflation
d. Occult ischaemic heart disease
e. Deconditioning

Correct answer

a. Exercise-induced bronchoconstriction

Both lung function and peripheral muscle force are important determinants of exercise capacity in COPD. The limitation to exercise in COPD is usually multifactorial in origin, partly reflecting some or all of:

- The consequences of airflow obstruction
- Dynamic hyperinflation
- Defective gas exchange
- Peripheral muscle dysfunction

The limitations in exercise capacity are worsened by the effects of physical deconditioning and may be further worsened by the presence of comorbid conditions such as arthritis or cardiac disease. Hence, in this patient, all of the answer options except exercise-induced bronchoconstriction, which largely occurs in asthma and is not suggested by the spirometry and reduced oxygen saturation after exercise, may explain this patient's exercise limitation.

Reference

Guenette JA, *et al.* Does dynamic hyperinflation contribute to dyspnoea during exercise in patients with COPD? *Eur Respir J* 2012; 40: 322–329.

HERMES Syllabus link: 1 Structure and function of the respiratory system, 3 Pulmonary function testing, 6 Airway diseases
Angoff rating: 61%

Question 47

A 49-year-old secretary is referred for dyspnoea on exertion and a chronic cough. She has been extensively examined for a persistent fever, but no infectious cause could be identified. She also complains of painful swelling of her wrists and her ankles; her thighs and her upper arms ache when she exercises. Her fingers suddenly hurt and turn white when she plays the accordion. She also has markedly thickened skin over her knuckles. Pulmonary function testing reveals an FVC of 70% predicted and FEV_1 of 75% pred; diffusing capacity of the lung for carbon monoxide is 45% pred. On HRCT, small pulmonary nodules and linear and ground-glass opacities of both lungs are found. Laboratory results are remarkable for elevated lactate dehydrogenase, creatine kinase and anti-Jo-1 antibody levels.
What is the most likely diagnosis for this patient?

a. Antisynthetase syndrome
b. Paraneoplastic disease
c. Rheumatoid arthritis
d. Systemic sclerosis
e. Sarcoidosis

Correct answer

a. Antisynthetase syndrome

The patient suffers from antisynthetase syndrome with the characteristic combination of inflammatory myositis, unexplained persistent fever, arthritis, Raynaud phenomenon and interstitial lung disease. Interstitial lung disease commonly presents as nonspecific interstitial pneumonitis. The skin over the knuckles is thickened as if the patient was performing hard physical work with her hands (Gottron's sign or mechanic's hands). Antisynthetase antibodies (*i.e.* anti-Jo-1) directed against several aminoacyl transfer RNA sythetases are elevated.
Paraneoplastic dermatomyositis could present similarly, but would lack arthritis and anti-Jo-1 would not be elevated. Rheumatoid arthritis would neither cause Raynaud's phenomenon nor mechanic's hands. Systemic sclerosis would not present with mechanic's hands and anti-Scl70, rather than anti-Jo-1, would be elevated. Sarcoidosis would not present with Raynaud phenomenon, mechanic's hands or anti-Jo-1 either.

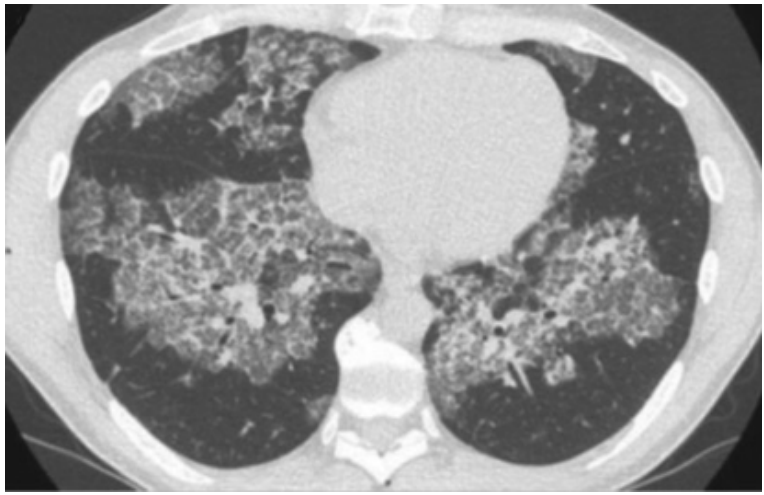
Reference

Connors GR, *et al.* Interstitial lung disease associated with the idiopathic inflammatory myopathies. *Chest* 2010; 138: 1464–1474.

HERMES Syllabus link: 13 Respiratory consequences of systemic/extrapulmonary disorders, 24 Immunodeficiency disorders
Angoff rating: 46%

Question 48

A 50-year-old female with an unremarkable previous medical history reports progressive dyspnoea. The chest CT is shown below.



Which one of the following is the most appropriate diagnostic evaluation to perform next?

a. Open-lung biopsy
b. CT-guided fine-needle biopsy
c. Bronchoalveolar lavage
d. Transbronchial biopsy
e. Pulmonary function tests

Correct answer

c. Bronchoalveolar lavage

The chest CT of this patient shows reticulations superimposed on irregular ground-glass opacities forming a 'crazy paving' pattern with a geographic distribution. This pattern is characteristic of pulmonary alveolar proteinosis (PAP). PAP is caused by impaired surfactant clearance by alveolar macrophages and alveolar accumulation of surfactant. The most common adult forms of PAP (previously named primary or idiopathic) are caused by autoantibodies against granulocyte–macrophage colony-stimulating factor (GM-CSF); alternatively, PAP may be related to inhalation of toxic particles or haematological disorders without GM-CSF autoantibodies. Furthermore, PAP may be due to mutations either in the GM-CSF receptors or in surfactant production-associated genes, which may be fatal in early infancy. The bronchoalveloar lavage (BAL) fluid in PAP has a milky appearance and contains large amounts of proteinaceous periodic acid–Schiff-positive material. The triad represented by 1) the typical crazy paving pattern on HRCT, 2) the macroscopic appearance of milky fluid and cytology of BAL fluid, and 3) an elevated serum level of GM-CSF autoantibodies is now considered sufficient to establish the diagnosis of autoimmune PAP. There is usually no need for lung biopsy, which must only be considered when one or more of the previous findings are missing. After confirmation of PAP by BAL fluid analysis, serological testing is helpful in differentiating primary PAP from secondary forms. Treatment of PAP includes whole-lung lavage and novel approaches such as recombinant GM-CSF therapy or treatments targeting anti-GM-CSF antibodies (rituximab or plasmapheresis). Lung transplantation is considered in end-stage disease but PAP may recur.

References

Borie R, *et al.* Pulmonary alveolar proteinosis. *Eur Respir Rev* 2011; 20: 98–107.

Wert SE, *et al.* Genetic disorders of surfactant dysfunction. *Pediatr Dev Pathol* 2009; 12: 253–274.

HERMES Syllabus link: 25 Orphan and rare lung diseases
Angoff rating: 56%

Question 49

A 49-year-old woman is referred for exercise testing to evaluate her dyspnoea. She stops the test because of dyspnoea at a maximal workload of 100 W (60% predicted) with a maximal oxygen uptake of 23 $mL \cdot kg^{-1} \cdot min^{-1}$ (58% predicted). Her heart rate reserve is 25 beats per min and her breathing reserve is 10%. Her inspiratory capacity before and at the end of the test is 1200 and 900 mL, respectively.
What is the most likely cause of her dyspnoea?

a. Deconditioning
b. Congestive heart failure
c. Hyperventilation
d. Obstructive airway disease
e. Neuromuscular disease

Correct answer

d. Obstructive airway disease

This patient's exercise capacity is decreased because of ventilatory limitation, reflected by an exhausted breathing reserve; a breathing reserve <15% indicates ventilatory limitation. Her inspiratory capacity decreased by 300 mL during exercise due to dynamic hyperinflation, which typically occurs in obstructive airway disease.
If her exercise capacity were limited by heart failure or deconditioning, the heart rate reserve would be exhausted. With hyperventilation and with neuromuscular disease, the inspiratory capacity, which is the difference between functional residual capacity and TLC, would not decrease during exercise.

Reference

O'Donnell DE, *et al.* Decline of resting inspiratory capacity in COPD: the impact on breathing pattern, dyspnea, and ventilatory capacity during exercise. *Chest* 2012; 141: 753–762.

HERMES Syllabus link: 3 Pulmonary function testing, 6 Airway diseases
Angoff rating: 52%

Question 50

A 33-year-old female in the second trimester of pregnancy presents to the emergency room due to progressive dyspnoea for the past 48 h. She has a history of asthma. Her BMI is 40.5 $kg \cdot m^{-2}$, heart rate is 130 beats per min and blood pressure is 110/75 mmHg. Breath sounds are diminished on both lung bases. The left calf is swollen. Her chest radiography is normal. Arterial blood gas analysis shows: P_{aO_2} 7.315 kPa (55 mmHg), P_{aCO_2} 3.99 kPa (30 mmHg) and pH 7.48 in room air.
Which of the following is the next diagnostic procedure?

a. D-dimer.
b. CT pulmonary angiography.
c. Compression ultrasonography of the legs.
d. Lung perfusion scintigraphy.
e. Echocardiography.

Correct answer

c. Compression ultrasonography of the legs.

D-dimers are typically elevated during pregnancy and, therefore, are not useful in this setting. Chest CT angiography and lung perfusion scintigraphy are both associated with ionising radiation and, therefore, should be used with caution in pregnancy. In the described case with a high pre-test probability for pulmonary embolism (Wells score 10), American Thoracic Society (ATS) and European Society of Cardiology (ESC) guidelines recommend compression ultrasound for deep-vein thrombosis (DVT) as the first diagnostic procedure. If this is positive, pulmonary embolism can be assumed and treated with heparin. Warfarin is teratogenic and contraindicated in pregnancy. In the absence of DVT symptoms or signs, the data are controversial: the ATS guidelines suggest a chest radiograph as the first radiation-associated test. If this is normal, ventilation/perfusion scintigraphy is recommended as the next step; if the radiograph is abnormal, chest CT angiography is suggested. The ESC suggests compression ultrasound in all cases of suspected pulmonary embolism in pregnancy. If this is negative, either a perfusion lung scan or chest CT angiography is recommended. Ventilation lung scan is not recommended because of approximately doubled fetal exposure to radiation compared with chest CT angiography or perfusion scan alone.

References

Elliott CG. Evaluation of suspected pulmonary embolism in pregnancy. *J Thorac Imaging* 2012; 27: 3–4.

Leung AN, *et al.* An official ATS/STR clinical practice guideline: evaluation of suspected pulmonary embolism in pregnancy. *Am J Respir Crit Care Med* 2011; 184: 1200–1208.

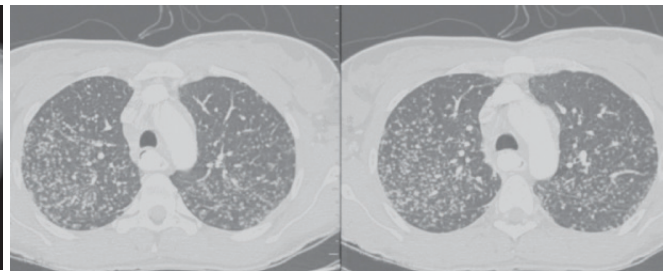
Torbicki A, *et al.* Guidelines on the diagnosis and management of acute pulmonary embolism: the Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC). *Eur Heart J* 2008; 29: 2276–2315.

Wells PS, *et al.* Derivation of a simple clinical model to categorize patients' probability of pulmonary embolism: increasing the model's utility with the SimpliRED D-dimer. *Thromb Haemost* 2000; 83: 416–420.

HERMES Syllabus link: 14 Pulmonary vascular diseases
Angoff rating: 58%

Question 51

A 36-year-old woman develops a mild dry cough and shortness of breath during exercise. Pulmonary function testing shows FEV_1 85% predicted, FVC 85% predicted, TLC 87% predicted and T_{LCO} 65% predicted. A chest radiograph and two HRCT images of the lung are shown below.



A bronchoalveolar lavage fluid cell count of 650 per µL was found, with 84% lymphocytes (CD4/CD8 ratio 0.1), 4% eosinophils and 2% basophils. Based on these findings, a differential diagnosis was made.

What is your next step in the management of this patient?

a. Search for precipitating IgG antibodies against ubiquitous antigens in the patient's serum.
b. Perform transbronchial lung biopsy.
c. Take a meticulous medical history of environmental exposures.
d. Prescribe inhaled corticosteroids.
e. Perform video-assisted thoracoscopic surgical lung biopsy.

Correct answer

c. Take a meticulous medical history of environmental exposures.

Several different diagnostic criteria for hypersensitivity pneumonitis have been proposed. All include a history of appropriate exposure to the suspected offending antigen(s) associated with the development of hypersensitivity pneumonitis as a major diagnostic criterion. Additional criteria in the diagnosis of hypersensitivity pneumonitis are compatible clinical, radiographic or physiological findings, and the presence of specific IgG in serum against the identified antigen (serum precipitins), although the latter may seldom be found in clinical practice due to low sensitivity. Common findings in hypersensitivity pneumonitis are crackles on chest auscultation, weight loss, cough, exertional dyspnoea and breathlessness, fever, wheezing, and fatigue. These findings are especially suggestive if present, appearing or worsening several hours after antigen exposure. Chest CT may reveal reticular, nodular or ground-glass opacities. Pulmonary function tests may reveal a restrictive, obstructive or mixed pattern along with a reduced T_{LCO}. Bronchoalveolar lavage usually shows lymphocytosis with a low CD4/CD8 ratio.

References

Selman M, *et al.* Hypersensitivity pneumonitis: insights in diagnosis and pathobiology. *Am J Respir Crit Care Med* 2012; 186: 314–324.

Lacasse Y, *et al.* Clinical diagnosis of hypersensitivity pneumonitis. *Am J Respir Crit Care Med* 2003; 168: 952–958.

Fenoglio CM, *et al.* Diagnostic value of serum precipitins to mould antigens in active hypersensitivity pneumonitis. *Eur Respir J* 2007; 29: 706–716.

HERMES Syllabus link: 10 Interstitial lung disease, 13 Respiratory consequences of systemic/extrapulmonary disorders, 16 Environmental diseases
Angoff rating: 51%

Question 52

A 35-year-old male is admitted to hospital because of acute onset of fever (38°C), dry cough, severe dyspnoea and mental confusion. Arterial blood pressure is 140/80 mmHg, heart rate is regular at 120 beats/min and respiratory rate is 36 breaths/min. Arterial blood gas analysis reveals a P_{aO_2} of 8.65 kPa (65 mmHg), P_{aCO_2} of 5.59 kPa (42 mmHg), bicarbonate concentration of 24.2 mmol·L^{-1} and a pH of 7.42. Chest radiography and CT show diffuse, bilateral pulmonary infiltrates. Bronchoalveolar lavage reveals 920×10^9 cells·L^{-1} with 35% eosinophils, 8% neutrophils and 57% macrophages. A broad search for parasitic infestation is negative.
Which of the following statements about this case is correct?

a. Blood eosinophilia is required to support the diagnosis.
b. The recommended treatment consists of broad-spectrum antibiotics.
c. Thoracoscopic lung biopsy is required to support the diagnosis.
d. Corticosteroids result in rapid resolution.
e. The prevalence of this condition is reduced in smokers.

Correct answer

d. Corticosteroids result in rapid resolution.

The high eosinophil count in the bronchoalveolar lavage (BAL) fluid suggests the presence of a form eosinophilic lung disease. Acute eosinophilic pneumonia (AEP) is usually accompanied by dyspnoea, fever and hypoxia, and develops within <1 week. It responds well to corticosteroids. The described case is consistent with this diagnosis and lung biopsy is not required. Chronic eosinophilic pneumonia is subacute with progressive symptoms of breathlessness, night sweats, weight loss, cough, fever and wheezing. The aetiology of AEP is unknown. It has been shown that in the initial phase of AEP, blood eosinophilia is not present, in contrast to marked eosinophilia (>25%) in the BAL fluid. Several drugs, including antibiotics, and chemical and physical agents, may induce AEP. A few studies have suggested a relationship between smoking and AEP, particularly new-onset smoking. Other reasons for pulmonary eosinophilia include helminth infections, coccidioidal infections, drugs (*e.g.* inhaled cocaine) and several toxins (particulate metals, aluminium silicate, solvents, *etc.*), medication (nonsteroidal anti-inflammatory drugs, ampicillin, sulfonamides, *etc.*), eosinophilic granulomatosis with polyangiitis, allergic bronchopulmonary aspergillosis, and hypereosinophilic syndrome.

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Menzies-Gow A. Eosinophilic disease. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 395–398.

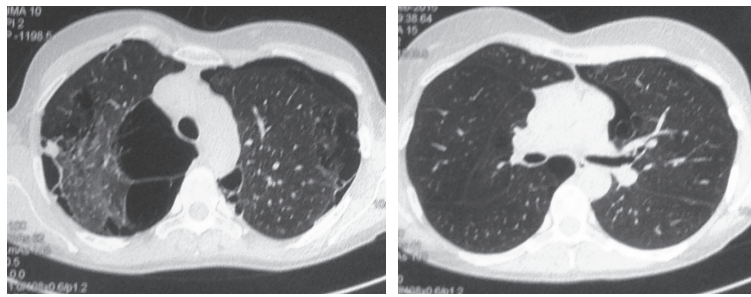
Philit F, *et al.* Idiopathic acute eosinophilic pneumonia: a study of 22 patients. *Am J Respir Crit Care Med* 2002; 166: 1235–1239.

Solomon J, *et al.* Drug, toxin, and radiation therapy-induced eosinophilic pneumonia. *Semin Respir Crit Care Med* 2006; 27: 192–197.

HERMES Syllabus link: 12 Eosinophilic diseases
Angoff rating: 52%

Question 53

A 69-year-old man with severe COPD comes to your office and requests to be scheduled for lung volume reduction surgery. He has been hospitalised five times in the last year for acute COPD exacerbations. He is severely dyspnoeic when moving between rooms and is confined to his home. He reports increasing frustration with his declining quality of life. He has no other significant health problems. The patient's current medical regimen includes ipratropium (four puffs, four times per day), salbutamol (two puffs, four times per day), sustained-release theophylline and nasal oxygen (3–4 L·min^{-1}). Following a 2-week course of prednisone (40 mg daily), the patient did not improve symptomatically or spirometrically. Physical examination reveals pursed-lip breathing, a respiratory rate of 22 breaths per min, diffusely diminished breath sounds, end-expiratory wheezes and trace pedal oedema. A recent chest CT is shown below.



The results of arterial blood gases studies on 3 L·min^{-1} nasal oxygen are shown below.

P_{aO_2} kPa (mmHg)	8.5 (64)
P_{aCO_2} kPa (mmHg)	5.6 (42)
pH	7.37
S_{aO_2} %	89
Carboxyhaemoglobin %	5.1

The results of pulmonary function studies are shown below.

FVC L (% predicted)	3.8 (81)
FEV_1 L (% predicted)	0.8 (24)
Post-bronchodilators	No improvement
TLC % predicted	132
Residual volume/TLC ratio	0.58
T_{LCO} % predicted	56

Which of the following is most appropriate at this time?

a. Lung transplantation
b. Lung volume reduction surgery
c. Bullectomy of the right upper lobe bulla
d. Pulmonary rehabilitation
e. Intermittent noninvasive positive pressure ventilation

Correct answer

d. Pulmonary rehabilitation

There are indications for surgical interventions, including lung transplantation or lung volume reduction surgery, in COPD patients who are still severely breathless after having had maximum medical treatment including pulmonary rehabilitation. This patient has not undergone rehabilitation so he should first try this. Moreover, age >65 years is a relative contraindication for lung transplantation. Indications for bullectomy include a bulla involving ≥30% of the hemithorax, FEV1 >40% predicted and no significant hypercapnia, so this patient is not a candidate for bullectomy. A recent study has shown improvement in 12-month mortality from intermittent noninvasive positive pressure ventilation in chronically hypercapnic COPD patients but this case has type I respiratory failure without hypercapnia. The elevated level of carboxyhaemoglobin raises the suspicion that the patient is smoking and this should be addressed too before surgical treatment is considered.

References

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Laros CD, *et al.* Bullectomy for giant bullae in emphysema. *J Thorac Cardiovasc Surg* 1986; 91: 63–70.

Ohta M, *et al.* Prediction of post-operative performance status in patients with giant bulla. *Chest* 1992; 101: 668–674.

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Köhnlein T, *et al.* Non-invasive positive pressure ventilation for the treatment of severe stable chronic obstructive pulmonary disease: a prospective, multicentre, randomised, controlled clinical trial. *Lancet Respir Med* 2014; 2: 698–705.

Fishman A, *et al.* A randomized trial comparing lung-volume-reduction surgery with medical therapy for severe emphysema. *N Engl J Med* 2003; 348: 2059–2073.

HERMES Syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases, 27 Associated specialties
Angoff rating: 62%

Question 54

In the National Emphysema Treatment Trial (NETT), cost-effectiveness of lung volume reduction surgery (LVRS) in patients with severe pulmonary emphysema was compared with medical treatment. The results revealed a cost-effectiveness ratio of LVRS of US$53 000 per quality adjusted life year (QALY) at 10 years of follow-up.
These results suggest that:

a. The estimated cost of LVRS is US$53 000 per patient.
b. The yearly estimated cost of LVRS is US$53 000 per patient.
c. LVRS costs more than medical treatment.
d. LVRS costs less than medical treatment.
e. The estimated cost of LVRS is US$5300 per patient.

Correct answer

c. LVRS costs more than medical treatment.

Novel medical treatments are traditionally evaluated in terms of the effects on symptoms, quality of life, morbidity and mortality. In times of dramatic increases in healthcare costs and limited financial resources, assessment of the costs of novel, potentially more effective treatments are increasingly important and crucial for decisions on resource allocation. Health economists apply a few basic concepts that a physician should know. Thus, the costs of a novel treatment are analysed in relation to its effects and compared with a reference treatment. This may involve extensive measurements, calculations and estimations.

Effectiveness is often assessed by subjective outcomes such as quality of life measures. In order to allow comparison among different diseases and treatments, generic instruments that are not specific to a particular disease are preferred. For application in economic analyses, the utility index is used. It is defined as the subjective preference of a patient for a given health state and rated on a scale anchored at 0, corresponding to death, and 1, corresponding to perfect health. By multiplying the utility index by the years spent in a particular health state, QALYs can be computed. The difference in costs between a treatment of interest and a reference treatment (or placebo) divided by the difference in QALY gained between the two treatments represents the cost-effectiveness ratio. The longer a patient stays alive with good quality after an intervention, the greater the QALY gained by this intervention and the lower its cost-effectiveness ratio. The value of the ratio is often not known from scientific studies but extrapolated to life time based on observations over a limited study period. Importantly, the costs not only include direct costs for healthcare but may involve significant indirect costs related to absence from work, for example.

In regard to LVRS, the NETT has shown that appropriately selected patients with severe pulmonary emphysema benefit from surgery in terms of quality of life and survival. The cost-effectiveness was calculated over the duration of the trial and extrapolated to 10 years of follow-up. A cost-effectiveness ratio of US$53 000 per QALY at 10 years indicates that LVRS is more expensive than medical treatment. Each additional year spent in perfect quality of life is estimated to cost US$53 000.

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HERMES Syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases
Angoff rating: 32%

Question 55

A 24-year-old nonsmoking woman was diagnosed with asthma 9 months ago, and has been on 500 µg beclomethasone and 9 µg formoterol, both twice daily, plus salbutamol as needed, since then. She has been asymptomatic for the past 3 months. Her FEV_1 is 3.8 L (97% predicted).
Which one of the following should you advise her to do?

a. Continue the same treatment
b. Reduce beclomethasone dosage
c. Discontinue formoterol
d. Discontinue salbutamol
e. Discontinue medication

Correct answer

b. Reduce beclomethasone dosage

The patient is on a high-dose inhaled corticosteroid (ICS) (1000 µg beclomethasone per day) and has been asymptomatic for 3 months. According to the Global Initiative for Asthma, asthma patients should have their dose adjusted to the lowest possible that assures control. High-dose ICS carries a risk of long-term side-effects, so her ICS should be reduced to a medium dose. Stepping down ICS doses by 25–50% at 3-month intervals is feasible and safe for most patients. If the patient remains asymptomatic for the next 3 months, formoterol may be discontinued. Salbutamol is prescribed as needed and should not be discontinued. Lastly, stepping down should be performed in intervals and, therefore, discontinuation of medication in a patient on high-dose treatment is contraindicated.

Reference

Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention. www.ginasthma.org/local/uploads/files/GINA_Report_2015_May19.pdf Date last updated: May 19, 2015.

HERMES Syllabus link: 6 Airway diseases
Angoff rating: 70%

Question 56

A 36-year-old woman presents to your office after coughing up 5–10 mL bright red blood the previous day. 3 days earlier she had noted the onset of a runny nose and frequent nonproductive cough. She denies experiencing fever, chest pain or dyspnoea. She has no previous history of haemoptysis but was hospitalised for pneumonia for 2 weeks at the age of 22 years. She has smoked half a pack of cigarettes per day for 16 years. She appears healthy except for a frequent nonproductive cough. The physical examination is normal, including vital signs, chest examination and cardiac examination. Laboratory studies show a haematocrit of 39%, leukocyte count of 8600 per μL and normal differential white blood cell count. Her platelet count is 175000 per μL, blood urea nitrogen is 14 $mg \cdot dL^{-1}$ (0.78 $mmol \cdot L^{-1}$) and serum creatinine is 0.8 $mg \cdot dL^{-1}$ (0.04 $mmol \cdot L^{-1}$). Urinalysis shows no erythrocytes, 40–50 leukocytes per high-power field, few bacteria and no protein by dipstick. No casts are seen. Chest radiography is normal.
Which of the following is the most appropriate diagnostic step to perform next?

a. Flexible bronchoscopy
b. CT of the chest
c. Endoscopy of the upper airways
d. Serum anti-neutrophil cytoplasmic antibody with cytoplasmic staining pattern and antiglomerular basement membrane antibody
e. Repeat chest radiography at 3 and 6 months

Correct answer

b. CT of the chest

This young woman's hemoptysis must be investigated immediately. As the chest radiograph is normal, a CT scan of the chest needs to be performed to localise the source and the eventual cause of the bleeding. CT should be performed before bronchoscopy to better plan the latter, invasive procedure. The haemoptysis in this patient is most likely caused by mucosal bronchial bleeding secondary to an acute respiratory infection on top of a chronic bronchitis due to smoking. Endoscopy of the upper airways should only be performed after active bleeding of the lower airways and the lung has been excluded because pulmonary haemorrhage is potentially more harmful than bleeding of the upper airways. There are no characteristic findings of granulomatosis with polyangiitis, such as upper airway or renal involvement. Goodpasture syndrome with antibodies against glomerular basal membrane is unlikely because there is no proteinuria.

Reference

Tsoumakidou M, *et al*. A prospective analysis of 184 hemoptysis cases: diagnostic impact of chest X-ray, computed tomography, bronchoscopy. *Respiration* 2006; 73: 808–814.

HERMES Syllabus link: 2 Signs and symptoms, 14 Pulmonary vascular diseases, 17 Respiratory emergencies
Angoff rating: 59%

Question 57

Which of the following findings is/are consistent with acute pulmonary embolism occluding less than 50% of the pulmonary vasculature?

a. A right pulmonary artery diameter of 35 mm on CT
b. A mean pulmonary arterial pressure of 50 mmHg
c. A right atrial pressure of 8 mmHg
d. A pulmonary arterial wedge pressure of 14 mmHg

Correct answers

c. A right atrial pressure of 8 mmHg
d. A pulmonary arterial wedge pressure of 14 mmHg

In acute pulmonary embolism, the diameter of the pulmonary artery is not enlarged. However, a diameter of the pulmonary artery of >29 mm has a sensitivity of 87% and specificity of 89% for a chronically elevated pulmonary arterial pressure. With a diameter of >33 mm, the specificity and sensitivity increase to 95%. Only with an obstruction of more than 50% will pulmonary hypertension (*i.e.* a mean pulmonary artery pressure >25 mmHg) develop. However, even with the most severe pulmonary embolism, the unconditioned right ventricle will not be able to achieve a pressure of >40 mmHg. Thus, an elevated mean pulmonary artery pressure of 50 mmHg is not consistent with acute pulmonary embolisms but might be a feature of chronic thromboembolic pulmonary hypertension (CTEPH). A slightly elevated right atrial pressure is compatible with acute pulmonary embolism. Typically, there is no left heart failure in acute pulmonary embolism and a normal pulmonary artery wedge pressure of 14 mmHg is compatible with this diagnosis.

References

Alpert JS, *et al.* Experimental pulmonary embolism; effect on pulmonary blood volume and vascular compliance. *Circulation* 1974; 49: 152–157.

Edwards PD, *et al.* CT measurement of main pulmonary artery diameter. *Br J Radiol* 1998; 71: 1018–1020.

Konstantinides S, *et al.* Management of venous thrombo-embolism: an update. *Eur Heart J* 2014; 35: 2855–2863.

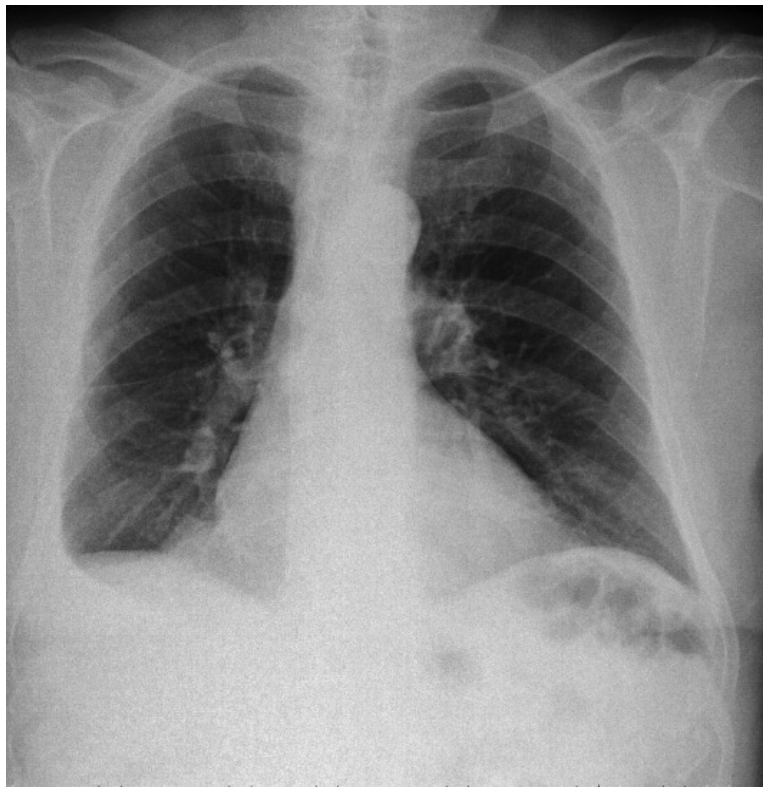
Tan RT, *et al.* Utility of CT scan evaluation for predicting pulmonary hypertension in patients with parenchymal lung disease. *Chest* 1998; 113: 1250–1256.

Wood MK, *et al.* Pulmonary embolism: clinical features and management. *Hosp Med* 2000; 61: 46–50.

HERMES Syllabus link: 4 Other diagnostic procedures, 14 Pulmonary vascular diseases
Angoff rating: 55%

Question 58

A 40-year-old, HIV-positive male consults his physician because of a 2-week history of right chest pain, night sweats and cough. His body temperature is 37.6 ºC and vital signs are normal, and there is dullness on percussion, reduced lung sounds and some rales on the right lower chest. The chest radiograph is shown below.



His C-reactive protein level is 119 $mg \cdot mL^{-1}$ (normal <5 $mg \cdot mL^{-1}$) and white blood cell count is 6570 cells per mm^3. His CD4 cell count was 437 per µL 5 months ago.
Which further examination should be recommended first?

a. Tuberculin skin test
b. Thoracentesis
c. Interferon-γ release assay
d. CT of the chest
e. Bronchoscopy

Correct answer

b. Thoracentesis

The clinical and radiological pattern is highly suggestive of pleurisy, which in an HIV-positive patient is likely to be tuberculous, depending also on the local epidemiology of tuberculosis and on the tuberculosis prevention measures that are in place. With a 2-week history, bacterial pneumonia is less likely. The tuberculin skin test (TST) is frequently negative in active tuberculosis in HIV-infected patients, including in pleural tuberculosis. However, a positive TST does not contribute to the differential diagnosis as it will only confirm tuberculosis infection, which is frequently latent. The same considerations are relevant for the interferon-γ release assay. Although chest CT and bronchoscopy might bring some useful information (including lung lesions not visible on chest radiography and bacteriological confirmation of *Mycobacterium tuberculosis*, respectively), thoracentesis is the first investigation to be recommended. Pleural fluid analysis may suggest a parapneumonic effusion by a predominance of neutrophils, low pH and/or isolation of bacteria. Conversely, it may show a lymphocytic-predominant effusion and cultural growth of mycobacteria, which would prove tuberculosis.

Reference

Lim RW. The undiagnosed pleural effusion. *Clin Chest Med* 2006; 27: 309–319.

HERMES Syllabus link: 8 Mycobacterial diseases, 20 Pleural diseases
Angoff rating: 67%

Question 59

A 55-year-old male consults you because of breathlessness, which has become gradually worse over a period of 1 year. He also has a cough but does not produce phlegm. He is able to walk for 10 min (distance 400–500 m) after which he has to rest because of shortness of breath. He has no chest pain on exertion. His complaints have been present throughout the entire year but become worse in a humid environment and during the winter. He has no known allergies and no family history of lung disease. He is a current smoker with a history of 40 pack-years. His general practitioner prescribed salbutamol 400 µg as needed. The patient reports that this gives him a little more air. His medical history is otherwise uneventful. The physical examination is unremarkable. A laboratory work-up including haemoglobin, haematocrit and a differential white blood cell count, and chest radiography, were normal. Spirometry reveals the following results.

	Predicted	Measured pre-bronchodilator	Measured post-bronchodilator	Change
FVC	3.75 L	2.34 L (62% pred)	2.75 L	0.41 L (+18%)
FEV1	2.78 L	0.91 L (32% pred)	1.09 L	0.18 L (+20%)
FEV1/FVC	73%	39%	40%	

Which of the following is the most likely diagnosis?

a. Asthma
b. Pulmonary Langerhans' cell histiocytosis
c. COPD
d. Obliterative bronchiolitis
e. Allergic bronchopulmonary aspergillosis

Correct answer

c. COPD

Reversible airway obstruction, a central hallmark of asthma, is generally defined as an improvement in post-bronchodilator FEV_1 of >12% compared with the pre-bronchodilator value and an absolute improvement of >200 mL. A positive bronchodilator response in asthmatics will usually also lead to a significant increase in the FEV_1/FVC ratio. Although in the past, COPD was seen as an irreversible airway disease (obstruction), it has become clear that COPD patients may show some reversibility after bronchodilation. In most cases, this will be due to a reduction in hyperinflation, improving FVC (volume response) and thereby FEV_1 too. In this case, the FEV_1/FVC ratio generally does not increase.

This seems to be the case in the current patient. Furthermore, the impovement in FEV_1 does not reach the 200 mL threshold. Thus, the most likely diagnosis is COPD (moderate COPD, Global Inititative for Chronic Obstructive Lung Disease (GOLD) grade 2) because of the patient's history, which does not suggest episodic worsening of symptoms or allergies but considerable exposure to cigarette smoke.

There is no radiological evidence of Langerhans' cell histiocytosis (LCH), although a conventional chest radiograph may not be sensitive enough to detect minor changes in early stages of the disease. LCH usually shows micronodular and reticular opacities on chest radiography, sparing the lower lobes. In advanced disease, the nodules are absent and the chest radiograph may suggest emphysema.

The onset of obliterative bronchiolitis is often at a younger age. A history of rheumatoid arthritis, exposure to toxic fumes or previous bone marrow transplantation would suggest this diagnosis.

Allergic bronchopulmonary aspergillosis is characterised by episodic bronchial obstruction (as in asthma), blood eosinophilia, IgE and precipitins against *Aspergillus* and elevated total IgE. It may be associated with pulmonary infiltrates on the chest radiograph.

References

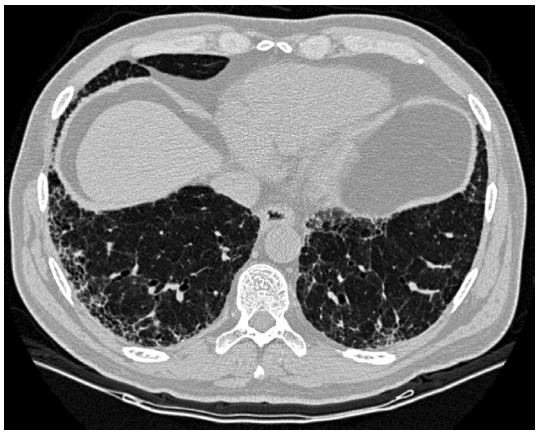
Global Intiative for Asthma. Global Strategy for Asthma Management and Prevention. 2010. www.ginasthma.org/local/uploads/files/GINA_Report_2015_May19.pdf Date last updated: May 19, 2015.

Global Initiative for Chronic Obstructive Lung Disease. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease. www.goldcopd.org/uploads/users/files/GOLD_Report_2015_Apr2.pdf Date last updated: April 2, 2015.

HERMES Syllabus link: 3 Pulmonary function testing, 6 Airway diseases
Angoff rating: 65%

Question 60

A 73-year-old retired insulating engineer presents with a 6-month history of increasing dyspnoea. He worked with asbestos for 2 years, 35 years ago. He has seronegative rheumatoid arthritis, finger clubbing and basal crackles on chest examination. The CT scan is shown below.



Which one of the following is the most likely diagnosis?

a. Idiopathic pulmonary fibrosis
b. Asbestosis
c. Rheumatoid lung
d. Lung adenocarcinoma
e. Bronchiectasis

Correct answer

a. Idiopathic pulmonary fibrosis

Asbestosis is unlikely because the patient's asbestos exposure was only 2 years in duration and his disease began more than 20 years later. Asbestosis seldom appears after such a long latent interval, particularly with a relatively short duration of exposure. He appears to have progressive disease and again this would be unlikely in asbestosis so long after cessation of exposure. The absence of pleural plaques is evidence against asbestosis, in which more than 95% of patients have pleural plaques demonstrable on chest CT. Progressive pulmonary fibrosis with basal crackles and finger clubbing in the absence of relevant asbestos exposure strongly suggests idiopathic pulmonary fibrosis (IPF). Rheumatoid lung with interstitial fibrosis is unlikely in seronegative disease, and finger clubbing is uncommon in rheumatoid pulmonary fibrosis. Lung adenocarcinoma remains a possible diagnosis but in this case is less likely than IPF and the CT does not suggest the presence of a cancer. Bronchiectasis is unlikely in the absence of cough and sputum production and finger clubbing seldom occurs nowadays except in patients with cystic fibrosis. Bronchiectasis is not a prominent feature in the presented CT.

References

Parkes WR, ed. Occupational Lung Disorders. 3rd Edn. London, Butterworth-Heinemann, 1994; p. 520.

Copley SJ, *et al.* Asbestosis and idiopathic pulmonary fibrosis: comparison of thin-section CT features. *Radiology* 2003; 229: 731–736.

HERMES Syllabus link: 10 Interstitial lung disease, 13 Respiratory consequences of systemic/extrapulmonary disorders, 15 Occupational diseases
Angoff rating: 60%

Question 61

A 58-year-old taxi driver is referred for evaluation of excessive sleepiness. His wife reports that he is a heavy snorer, has frequent breathing pauses during sleep and appears to be increasingly depressed and without energy. Nocturnal pulse oximetry reveals repetitive oxygen desaturations (dip rate >4%, 34 events per h).
Which of the following treatments is most likely to improve his symptoms?

a. Nocturnal supplemental oxygen
b. Nocturnal CPAP
c. Uvulopalatopharyngoplasty
d. Acetazolamide at bedtime
e. A tricyclic antidepressant at bedtime

Correct answer

b. Nocturnal CPAP

Based on the typical clinical presentation consisting of excessive daytime sleepiness, snoring, witnessed apnoeas and nocturnal pulse oximetry demonstrating an elevated oxygen desaturation index of 34 events per h, this patient suffers from OSAS. The treatment of choice is nocturnal CPAP *via* a nasal or oronasal mask. None of the other presented treatments has been shown to be beneficial to OSAS patients. Supplemental oxygen does not prevent upper airway collapse, the pathophysiological hallmark of OSAS. Very few randomised trials have evaluated upper airway surgery as treatment for OSAS and their results were negative. Acetazolamide, a carbonic anhydrase inhibitor that stimulates ventilation by inducing metabolic acidosis, has been found to improve central sleep apnoea at high altitude but the drug is not an effective treatment for OSAS. Tricyclic antidepressants may reduce rapid eye movement sleep and possibly snoring but their effect on OSAS is not clinically relevant.

References

Simonds AK. Positive airway pressure treatment. *In:* Simonds AK, *et al.*, eds. ERS Handbook of Respiratory Sleep Medicine. Sheffield, European Respiratory Society, 2012; pp. 157–163.

Verbraecken J, *et al.* Treatment of obstructive sleep apnoea. *In:* Simonds AK, *et al.*, eds. ERS Handbook of Respiratory Sleep Medicine. Sheffield, European Respiratory Society, 2012; pp. 147–156.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 78%

Question 62

Regarding diffusing *T*LCO, which of the following statement(s) is/are correct?

a. Among routine pulmonary function tests, single-breath *T*LCO is the most sensitive method to detect abnormalities in pulmonary gas exchange.
b. Broadening of the alveolar–capillary membrane is the most common cause of decreased *T*LCO.
c. Measured *T*LCO is significantly dependent on the available surface area for gas exchange.
d. Anaemia alone can cause a reduction in the measurement of *T*LCO, even in patients with normal lungs.

Correct answers

a. Among routine pulmonary function tests, single-breath *T*LCO is the most sensitive method to detect abnormalities in pulmonary gas exchange.
c. Measured *T*LCO is significantly dependent on the available surface area for gas exchange.
d. Anaemia alone can cause a reduction in the measurement of *T*LCO, even in patients with normal lungs.

*T*LCO is a sensitive measure of the transfer of gas from the alveoli to red blood cells in lung capillaries. Loss of pulmonary capillaries and the subsequent shrinking of the gas exchange surface is the most common cause of impaired *T*LCO while broadening of the alveolar–capillary barrier is another, but rarer, cause of decreased diffusion. Anaemia reduces *T*LCO because fewer red blood cells pass through the lung per unit time.

References

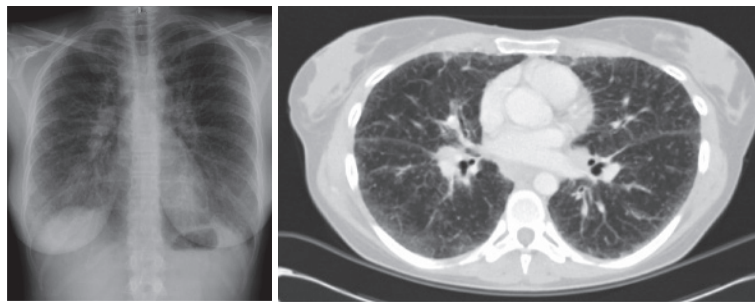
Hughes JM. Examination of the carbon monoxide diffusing capacity ($D_{L_{CO}}$) in relation to its *K*CO and *V*A components. *Am J Respir Crit Care Med* 2012; 186: 132–139.

Hughes JM. Gas transfer: *T*LCO and *T*LNO. *In:* Palange P *et al.* eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 77–81.

HERMES Syllabus link: 3 Pulmonary function testing
Angoff rating: 57%

Question 63

A 30-year-old nonsmoking female primary school teacher presents with new symptoms of non-productive cough for 3 weeks. Once a week, she gives evening lessons in stone sculpting and is exposed to silica dust. She never wears a protective mask. She has no dyspnoea on exertion and is otherwise well. Pulmonary function shows a mild restrictive pattern with an FVC of 92% predicted. Her chest X-ray and chest CT scan are shown below.



Which of the following statements is correct?

a. Silicosis and miliary tuberculosis should be ruled out with a surgical lung biopsy before starting treatment.
b. Transbronchial biopsy is indicated with an expected diagnostic yield of >60%.
c. A bronchoalveolar lavage fluid lymphocyte CD4/CD8 ratio of >3.5 is >90% sensitive and specific for the suspected disease.
d. A trial with systemic corticosteroids is indicated for differential diagnosis.
e. The suspected disease can be diagnosed by serum analysis with >90% sensitivity and specificity.

Correct answer

b. Transbronchial biopsy is indicated with an expected diagnostic yield of >60%.

The case is typical of sarcoidosis in many respects. This multisystem granulomatous disorder commonly affects young and middle-aged adults. It presents with bilateral hilar lymphadenopathy, pulmonary infiltrates, and sometimes systemic manifestations affecting the eyes, skin, joints, heart, liver or even the central nervous system. Any other organ may also be involved. The symptoms are largely unspecific.

Diagnosis is usually made by a biopsy. If the lung tissue is visibly affected, as in this case, the diagnostic yield of a transbronchial biopsy exceeds 80%. Bronchoalveolar lavage may be helpful as well but high helper/suppressor cell ratios (>4) are only specific for sarcoidosis if combined with a transbronchial biopsy that supports the diagnosis; a low CD4/CD8 ratio (<1) has a very high negative predictive value for sarcoidosis. Systemic glucocorticoids may be indicated in an attempt to halt progression of pulmonary function decline but not in supporting any differential diagnosis. Serum markers such as angiotensin-converting enzyme are sometimes used in the initial evaluation and follow-up as a marker of activity but are not diagnostic for the disease.

References

Costabel U, *et al.* Diagnostic modalities in sarcoidosis: BAL, EBUS, and PET. *Semin Respir Crit Care Med* 2010; 31: 404–408.

Baughman RP, *et al.* Sarcoidosis. *Semin Respir Crit Care Med* 2010; 31: 373–374.

Grutters JC, *et al.* Corticosteroid treatment in sarcoidosis. *Eur Respir J* 2006; 28: 627–636.

Hunninghake GW, *et al.* ATS/ERS/WASOG statement on sarcoidosis. *Sarcoidosis Vasc Diffuse Lung Dis* 1999; 16: 149–173.

HERMES Syllabus link: 10 Interstitial lung disease, 13 Respiratory consequences of systemic/extrapulmonary disorders, 16 Environmental diseases
Angoff rating: 59%

Question 64

A 37 year-old patient presents with adult-onset asthma. Due to increased production of brownish sputum production, and perihilar and upper lobe opacities on a conventional chest radiograph, a CT scan is performed showing central bilateral bronchiectasis and infiltrates. Bronchoscopy shows mucus plugs in the central airways.
Which of the following statements concerning a suspected underlying disorder is correct?

a. Fungal invasion of the bronchial mucosa is typically found in bronchoscopic biopsy specimens.
b. Total serum IgE and blood eosinophils are typically normal.
c. Patients with cystic fibrosis are more often affected than healthy persons.
d. Immunosuppressive therapy should be started with a combined regimen of glucocorticoids and cyclophosphamide or a monoclonal antibody against CD20 receptor.
e. Antifungal treatment has no role in the therapy.

Correct answer

c. Patients with cystic fibrosis are more often affected than healthy persons.

The patient has allergic bronchopulmonary aspergillosis (ABPA), a hypersensitivity reaction to *Aspergillus* spp. (generally *A. fumigatus*) occurring almost exclusively in patients with asthma or cystic fibrosis. The immune response to *Aspergillus* antigens causes airway obstruction and, if untreated, bronchiectasis, and ultimately fibrotic, bullous or cavitary lung lesions. Productive cough is a typical symptom. Some patients present with fever and weight loss. Diagnosis can be suspected based on history and thoracic imaging, and is confirmed by a positive skin test against *Aspergillus* antigen, and measurement of IgE and *A. fumigatus*-specific antibodies. Treatment usually starts with systemic corticosteroids. In refractory cases, itraconazole may be added. Apart from antifungal action, itraconazole may also act by an anti-inflammatory effect and interferes with the hepatic metabolism of methylprednisolone augmenting its effect (this does not apply to prednisolone, which is most often used). Antimetabolites and anti-CD20 receptor monoclonal antibodies are used in combination with glucocorticoids in the treatment of vasculitis but not in ABPA.

References

Eaton T, *et al.* Allergic bronchopulmonary aspergillosis in the asthma clinic. A prospective evaluation of CT in the diagnostic algorithm. *Chest* 2000; 118: 66–72.

Kosmidis C, *et al.* The clinical spectrum of pulmonary aspergillosis. *Thorax* 2015; 70: 270–277.

Shah A, *et al.* Allergic aspergillosis of the respiratory tract. *Eur Respir Rev* 2014; 23: 8–29.

Stevens DA, *et al.* A randomized trial of itraconazole in allergic bronchopulmonary aspergillosis. *N Engl Med J* 2000; 342: 756–762.

HERMES Syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases
Angoff rating: 65%

Question 65

Which one of the following statements is correct regarding long-term use of inhaled corticosteroids in the treatment of moderate to severe COPD?

a. It reduces mortality.
b. It reduces the frequency of exacerbations.
c. It reduces the rate of decline of FEV1.
d. It reduces the incidence of pneumonia.
e. It has no significant adverse side-effects.

Correct answer

b. It reduces the frequency of exacerbations.

The Cochrane review by Yang *et al.* (2012) included 55 studies with 16 154 participants. It showed that the long-term use of inhaled corticosteroids (ICS) reduced the mean rate of exacerbations by more than 0.25 exacerbations per patient per year. Long-term use of ICS had no statistically significant effect on mortality in COPD patients and did not consistently reduce the rate of FEV1 decline in COPD. ICS increased the risk of oropharyngeal candidiasis, hoarseness and the incidence rate of pneumonia. Additionally, the review also showed that ICS slowed the rate of decline in quality of life, as measured by the St George's Respiratory Questionnaire.

Reference

Yang IA, *et al.* Inhaled corticosteroids for stable chronic obstructive pulmonary disease. *Cochrane Database Syst Rev* 2012; CD002991.

HERMES Syllabus link: 6 Airway diseases
Angoff rating: 58%

Question 66

A 63-year-old healthy woman, who has never smoked, has been visiting her family, including three grandchildren. The children have been suffering from a febrile illness, passing it between one another, and two of them have had severe earaches. After being at their home for 2 weeks, the patient experiences a nonproductive cough, fever and weakness. Her chest radiograph shows a right mid-lung infiltrate and a small pleural effusion. The white blood count of her pleural fluid is 560 cells per mm^3. The cold agglutinin titre of her acute serum is 1:16. She responds to treatment with erythromycin.
What could be done to confirm or rule out a diagnosis of *Mycoplasma* pneumonia?

a. Obtain a second cold agglutinin titre 3–6 weeks later; if the titre fails to show at least a four-fold rise, this has to be considered strong evidence against the diagnosis.
b. Obtain acute and convalescent titres of complement-fixing antibody against *Mycoplasma pneumoniae*; if there is at least a four-fold increase in titre, this is strong evidence confirming the diagnosis.
c. Wait for results of throat washings cultured for *M. pneumoniae*; if the cultures are negative, this is strong evidence against the diagnosis.
d. Study the serum complement-fixing antibody against *Chlamydophila pneumoniae* (TWAR) because a titre of 1:16 or greater would strongly favour a diagnosis of chlamydial pneumonia.
e. Avoid ordering additional tests because effusions are rare in *Mycoplasma* pneumonia and this makes the diagnosis most unlikely.

Correct answer

b. Obtain acute and convalescent titres of complement-fixing antibody against *Mycoplasma pneumoniae*; if there is at least a four-fold increase in titre, this is strong evidence confirming the diagnosis.

Mycoplasma pneumonia can present with cough and chest pain, and be accompanied by wheezing. Nonrespiratory symptoms, such as arthralgia and headache, might also suggest *Mycoplasma* infection. The complement fixation test (CFT) is still regarded as the gold standard for diagnosis of *M. pneumoniae* pneumonia. Elevated CFT titres are detected no earlier than 10–14 days after the onset of mycoplasma infection. Titration of antibodies in acute- and convalescent-phase serum specimens is usually performed. A four-fold increase in titre can confirm the diagnosis. If cold agglutinins are present in a patient with community-acquired pneumonia, the higher the cold agglutinin titre (>1:64), the more likely the cold agglutinins are due to *M. pneumoniae*. *M. pneumoniae* infections may also be diagnosed by cultivation of the organism on complex agar medium. Because of the slow growth of the organism, partly reflecting fastidious nutrient requirements, culture techniques are expensive and slow.

References

Lim WS, *et al.* BTS guidelines for the management of community acquired pneumonia in adults: update 2009. *Thorax* 2009; 64: Suppl. 3, iii1–iii55.

Harris M, *et al.* British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011. *Thorax* 2011; 66: Suppl. 2, ii1–ii23.

HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 57%

Question 67

A 52-year-old patient with severe late-onset intrinsic asthma and a history of sinusitis stopped taking systemic corticosteroids 4 weeks ago. Now, he is suffering from fever, malaise and moderate weight loss. Due to severe chest pain that does not allow the patient to lie on his left side, he is referred to the intensive care unit. On auscultation, a pericardial friction rub is audible. On his skin, several new-onset haemorrhagic lesions are visible. His creatine kinase (CK) and CK-MB are elevated.
Which laboratory test could best help to support the suspected diagnosis?

a. Blood eosinophil count
b. Skin prick test for *Aspergillus* sp.
c. Anti-basement membrane antibodies
d. Anti-synthetase antibodies (Jo-1)
e. Troponin T

Correct answer

a. Blood eosinophil count

Peripheral blood eosinophils >10% are a hallmark of eosinophilic granulomatosis with polyangiitis. This multisystem disorder is characterised by asthma, blood eosinophilia, sinusitis and, in some cases, mononeuritis multiplex, pericarditis and cardiac arrhythmia.
Skin prick test for *Aspergillus* sp. would help in the diagnosis of allergic pulmonary aspergillosis, another disease associated with asthma. Anti-basement membrane antibodies are elevated in Goodpasture's syndrome, which is associated with renal glomerular disease and pulmonary alveolar haemorrhage. Anti-synthetase antibodies (Jo-1; anti-aminoacyl transfer RNA antibodies) are elevated in idiopathic anti-inflammatory diseases with arthritis, myopathy and Raynaud's syndrome, which can be associated with interstitial lung disease. Cardiac troponin T is expected to be elevated in this patient with probable perimyocarditis, as suggested by an elevated CK-MB; however, elevated troponin would not help to secure the diagnosis, as the suspected cardiac involvement is just one manifestation of the vasculitic disease.

References

Frankel SK, *et al.* The pulmonary vasculitides. *Am J Respir Crit Care Med* 2012; 186: 216–224.

Mouthon L, *et al.* Diagnosis and classification of eosinophilic granulomatosis with polyangiitis (formerly named Churg–Strauss syndrome). *J Autoimmun* 2014; 48–49: 99–103.

HERMES Syllabus link: 6 Airway diseases, 14 Pulmonary vascular diseases
Angoff rating: 54%

Question 68

Which of the following treatments has/have been shown to reduce mortality among selected patients with COPD in prospective randomised studies?

a. Long-term oxygen therapy
b. Pulmonary rehabilitation
c. A combination of an inhaled long-acting β-adrenergic agent and a corticosteroid
d. Lung volume reduction surgery

Correct answers

a. Long-term oxygen therapy
d. Lung volume reduction surgery

The Nocturnal Oxygen Therapy Trial and the UK Medical Research Council study, carried out about 30 years ago, showed a significantly improved survival with continuous (>16 h per day) oxygen supplementation in COPD patients who were hypoxaemic (P_{aO_2} <7.3 kPa (<55 mmHg) or 7.3–7.9 kPa (55–59 mmHg) with signs of right heart failure) in a stable phase of their disease. A meta-analysis of the effects of pulmonary rehabilitation in COPD patients did not show a significant effect on survival of pulmonary rehabilitation. In the large randomised controlled Towards a Revolution in COPD Health trial, where COPD patients were treated with a combination of salmeterol with fluticasone, salmeterol alone or fluticasone alone, no significant improved survival was observed between these different treatment groups. Severe COPD patients with a heterogenous, predominantly upper lobe emphysema, who did not improve after a period of pulmonary rehabilitation, had an improved survival after lung volume reduction surgery.

References

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Stoller JK, *et al.* Oxygen therapy for patients with COPD. Current evidence and the long-term oxygen treatment trial. *Chest* 2010; 138: 179–187.

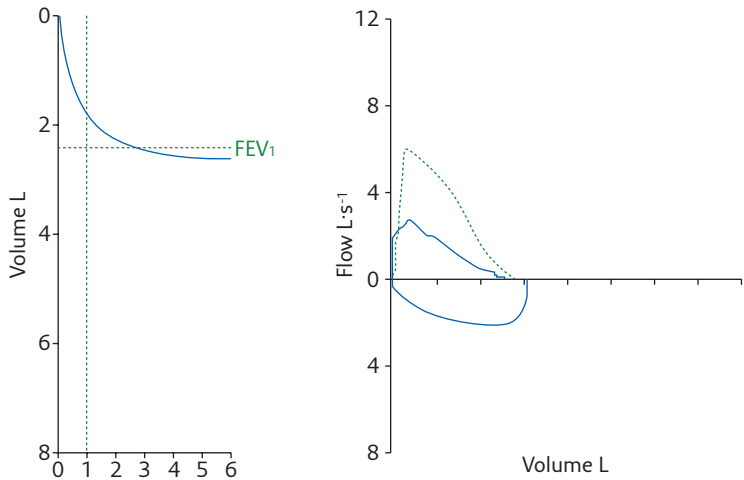
HERMES Syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases
Angoff rating: 59%

Question 69

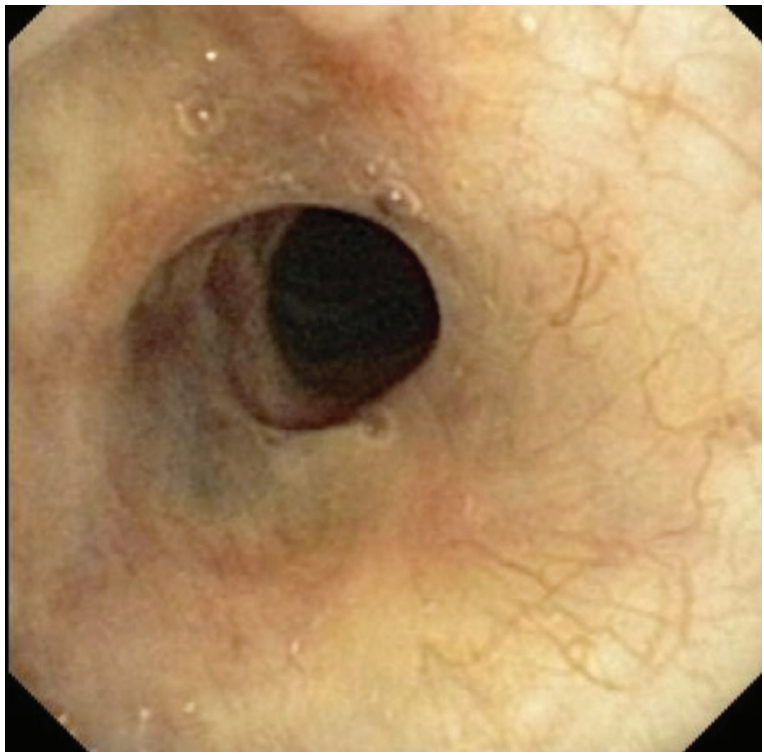
A 72-year-old, previously healthy, nonsmoking woman suffers from progressive dyspnoea on exertion for several months. Treatment with a combined corticosteroid and long-acting β-adrenergic agonist inhaler for 3 months did not provide significant relief of symptoms. Clinical examination reveals a slight inspiratory and expiratory stridor but is otherwise normal. The spirometry results and flow–volume curve are shown in below.

Parameter	Predicted	Measured	% predicted
FVC_{ex} L	2.90	2.63	91
FEV_1 L	2.45	1.79	73
FEV_1/FVC_{ex} %	77	68	88
PEF $L \cdot s^{-1}$	6.22	2.74	44
$MEF_{75\%}$ $L \cdot s^{-1}$	5.43	2.37	44
$MEF_{50\%}$ $L \cdot s^{-1}$	3.70	1.55	42
$MEF_{25\%}$ $L \cdot s^{-1}$	1.31	0.63	48
$MEF_{25-75\%}$ $L \cdot s^{-1}$	2.90	1.31	45

FVC_{ex}: expiratory FVC; PEF: peak expiratory flow; $MEF_{x\%}$: maximum expiratory flow at x% of FVC.



Bronchoscopic inspection of the trachea revealed the findings shown below.



Laboratory tests, including C-reactive protein, and red and white blood cell counts, were within normal limits.
Which one of the following is the most appropriate treatment?

a. Methotrexate
b. Isoniazid, rifampicin, pyrazinamide and ethambutol
c. Prednisone
d. Resection
e. Radiation

Correct answer

d. Resection

The spirometry shows airflow obstruction with reduction of both expiratory and inspiratory airflow without improvement over the course of 3 months despite bronchodilator therapy. Unexplained airflow obstruction should prompt evaluation of causes other than just COPD or asthma, including large airway obstruction by tumours, foreign bodies, inflammatory diseases and vocal cord dysfunction. Depending on the clinical presentation, initial evaluation should include imaging (chest radiography or CT) and endoscopy. In this case, bronchoscopy revealed a circular, web-like, subglottic stenosis consistent with idiopathic subglottic stenosis, a form of idiopathic laryngotracheal stenosis. This disorder is a diagnosis of exclusion. Tracheal stenosis might be caused by external trauma, intubation or tracheostomy, inhalation injury, irradiation, infection (bacterial, mycobacterial or diphtheria), gastro-oesophageal reflux, collagen vascular disease (granulomatosis with polyangiitis), relapsing polychondritis and sarcoidosis. The history, physical examination and laboratory tests do not suggest any of these causes in this patient. Treatment of a clinically relevant idiopathic tracheal stenosis is by resection as none of the other treatments listed would be effective.

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HERMES Syllabus link: 6 Airway diseases
Angoff rating: 50%

Question 70

A 35-year-old Caucasian male from South Africa, currently a resident of London, UK, presents to the emergency room with productive cough and low-grade fever of approximately 6 weeks' duration. Six months ago, during a stay in South Africa, he had received treatment with isoniazid, rifampicin, pyrazinamide and ethambutol for smear-positive pulmonary tuberculosis. The treatment had led to rapid clinical improvement and he therefore stopped it upon return to London, after a duration of 8 weeks.

Clinical examination at admission reveals a BMI of 18 $kg \cdot m^{-2}$ and a temperature of 37.8°C but no other abnormal findings. Chest radiography shows bilateral upper lobe infiltrates with a cavitary lesion in the right upper lobe. The sputum contains acid-fast bacilli. A HIV test is negative. Results of rapid molecular-based drug susceptibility tests are pending.

Which of the following should be recommended for this patient?

a. Initiate regimen with 2HRZES/1HRZE/5HRE
b. Await results of molecular susceptibility testing
c. Complete treatment with 4HR
d. Start prolonged treatment with 2HRZE/6HE
e. Restart standard regimen with 2HRZE/4HR

H: isoniazid; R: rifampicin; Z: pyrazinamide; E: ethambutol; S: streptomycin. Numbers before the letters denote the duration of treatment in months.

Correct answer

b. Await results of molecular susceptibility testing

This patient presents with active TB after default interruption of treatment. Previous treatment is a strong determinant of drug resistance and multidrug resistance (MDR). A global survey has revealed that 15% of previously treated patients had MDR, compared with 3% of new cases. Therefore, particular precautions should be taken to avoid inappropriate treatment and thereby promote and spread MDR. Prompt MDR identification enables the physician to specifically select an appropriate combination of drugs. This enhances the chance of cure and contributes to the prevention of spread of resistant strains. Using rapid molecular-based tests, MDR can be confirmed or excluded within 1–2 days. Such tests are available in many European countries (as in the described case) and the results should be used to guide treatment.

If rapid drug susceptibility tests are not available, empirical treatment should be started based on the likelihood of MDR-TB. This likelihood is considered high in patients with treatment failure, who should receive empirical treatment for MDR-TB. Conversely, in patients returning with a relapse or after defaulting, the likelihood of MDR is lower (in countries with a low MDR prevalence) and a retreatment regimen containing first-line drugs is acceptable, *i.e.* 2HRZES/1HRZE/5HRE is the recommended empirical retreatment in this setting. If the results of susceptibility testing become available, treatment should be adapted accordingly. A treatment failure, a second or subsequent relapse or default of a previous treatment, a high local rate of MDR and co-existent HIV infection are important criteria for selection of the retreatment regimen.

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HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 43%

Question 71

A 33-year-old man presents with minor haemoptysis, fatigue, weight loss and recurrent nasal bleeding. The chest radiograph discloses multiple dense infiltrates, some with cavitation, and the serum cytoplasmic anti-neutrophil cytoplasmic antibody (cANCA) test is positive with elevated anti-proteinase 3 (PR3) IgG.

Which of the following initial treatments is most appropriate for the suspected disease?

a. Infliximab
b. Methotrexate
c. Azathioprine and prednisone
d. Cyclophosphamide and prednisone
e. Mycophenolate and prednisone

Correct answer

d. Cyclophosphamide and prednisone

This is a case of granulomatosis with polyangiitis. While glucocorticoid therapy alone extends the 5-month mean survival of untreated cANCA-related vasculitis by only a few months, the addition of immunosuppressive agents (cyclophosphamide) to glucocorticoids is highly beneficial. Only localised or early systemic disease without the threat of vital organ involvement may be treated with methotrexate and glucocorticoids, based on the dosing regimen used in the NORAM (Nonrenal Wegener's Granulomatosis Treated Alternatively with Methotrexate) study, as this appears as effective as cyclophosphamide and avoids the toxicity of the latter. Tumour necrosis factor inhibition with infliximab may have a role in refractory disease but not in routine induction regimens.

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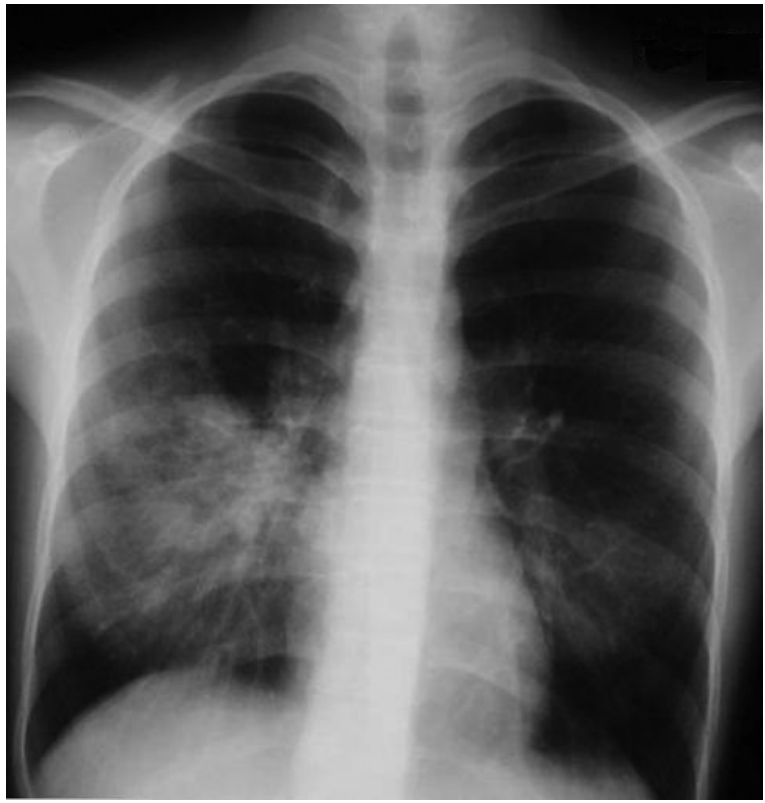
HERMES Syllabus link: 12 Eosinophilic diseases, 14 Pulmonary vascular diseases
Angoff rating: 53%

Question 72

A 28-year-old female complains of a 1-week history of severe hacking dry cough, slight dyspnoea and weakness. On examination, she is mildly unwell but fully orientated and not cyanosed. However, she is pyrexial, pale and slightly jaundiced. A full blood cell count shows normochromic anaemia with Hb of 9 $g \cdot dL^{-1}$ and neutrophil leukocytosis. Liver function tests show mild elevation of unconjugated bilirubin and raised lactate dehydrogenase. Blood urea and electrolytes are normal. There is no proteinuria. Results of blood cultures are pending. The chest radiograph is shown below.



Which of the following additional investigations would be most likely to provide a diagnosis?

a. *Chlamydia* serology
b. Anti-neutrophil cytoplasmic antibody
c. Urine test for *Legionella*
d. *Mycoplasma* serology
e. Anti-basement membrane antibody

Correct answer

d. *Mycoplasma* serology

From the patient's history, pneumonia is likely but the radiology does not suggest pneumococcal or other bacterial aetiology, although blood cultures have been performed to evaluate this possibility as recommended in severe pneumonia. Atypical infection is, therefore, probable but the degree of anaemia is unusual. The associated jaundice indicates that she may be haemolysing. In the context of atypical pneumonia, this suggests *Mycoplasma pneumoniae* pneumonia with haemolytic anaemia due to cold agglutinins. Severe haemolysis in *Mycoplasma pneumoniae* pneumonia is uncommon but well recognised. It can usually be controlled by keeping the patient warm. Serology would confirm the diagnosis, and tests for cold agglutinins and Coomb's test would be positive. Haemolytic anaemia does not fit the typical presentation of legionnaires' disease or *Chlamydia* infection. The association of pulmonary infiltrates and anaemia suggest pulmonary haemorrhage due to vasculitic disease or Goodpasture's disease, but the absence of haemoptysis or significant proteinuria or renal failure does not support these possibilities.

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HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 45%

Question 73

A 45-year-old male complains of dyspnoea on minimal exertion, orthopnoea and near fainting. In the past few years, the patient has reportedly suffered from several episodes of haematemesis and an oesophagogastroduodenoscopy had shown that this was due to oesophageal varices. On physical examination, he is pale, his blood pressure is 110/75 mmHg, heart rate is 74 beats per min and regular, and S_{pO_2} in room air is 94%. There is a split second heart sound, pulmonary auscultation is normal, abdominal examination suggests ascites and he has bilateral lower limb oedema. Echocardiography reveals an estimated systolic pulmonary artery pressure of 45 mmHg and a left ventricular ejection fraction of 55%.
Which of the following is the most likely diagnosis?

a. Hepatopulmonary syndrome
b. Portopulmonary hypertension
c. Recurrent pulmonary embolism
d. Left ventricular failure
e. Systemic sclerosis

Correct answer

b. Portopulmonary hypertension

Portopulmonary hypertension is defined as the coexistence of portal hypertension and pulmonary hypertension after exclusion of connective tissue disease, HIV, drug- and toxin-related pulmonary hypertension, or congenital heart disease. Pulmonary hypertension is defined according to right heart catheterisation by a mean pulmonary artery pressure ≥25 mmHg at rest. A wedge pressure of ≤15 mmHg excludes pulmonary hypertension due to left ventricular failure. Portal venous pressure is usually 5–10 mmHg. Hepatopulmonary syndrome refers to the triad of hepatic disease, impaired oxygenation and intrapulmonary vascular dilatation. It typically manifests with platypnoea and orthodeoxia. Pulmonary embolism and systemic sclerosis do not lead to portal hypertension and oesophageal varices. Portal hypertension is typically caused by liver cirrhosis, recurrent infection of portal veins, HIV and some toxic substances.

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HERMES Syllabus link: 13 Respiratory consequences of systemic/extrapulmonary disorders
Angoff rating: 48%

Question 74

A 53-year-old obese male (BMI 30.1 $kg \cdot m^{-2}$) is diagnosed with OSA with an AHI of 45 events per h and an oxygen desaturation index of 40 events per h. He is given auto-adjusting nasal CPAP therapy with an allowed pressure range of 5–15 cmH_2O. On the first night of adaptation, his AHI went down to 6 events per h and his ODI was 4 events per h. 3 days later, the patient reported that his sleepiness had already improved significantly. 1 month later, the patient returned to the sleep laboratory and complained of recurring daytime sleepiness. Ambulatory pulse oximetry showed an oxygen desaturation index of 34 events per h. Data downloaded from the CPAP machine suggested an adequate compliance by the patient as the machine was used for 5.48 h per night on average. The applied pressure ranged from 5 to 13.5 cmH_2O and the 90th pressure percentile was 12 cmH_2O. Which one of the following steps is the least promising in this situation?

a. Switch to bilevel positive airway pressure ventilation.
b. Switch to constant CPAP of 12 cmH_2O.
c. Perform uvulopalatopharyngoplasty.
d. Switch to adaptive servoventilation.
e. Switch to mandibular advancement device.

Correct answer

c. Perform uvulopalatopharyngoplasty

CPAP is usually effective in patients with OSAS. Optimal treatment of patients with predominantly mixed apnoeas, central sleep apnoea syndrome/Cheyne–Stokes respiration (CSA/CSR) or complex sleep apnoea is less clear, but includes other positive pressure ventilation modalities. This patient most probably has complex sleep apnoea, *i.e.* central apnoeas emerging after initial successful CPAP therapy. The clinical relevance of complex sleep apnoea is still a matter of debate, as studies suggest that complex sleep apnoeas disappear during prolonged CPAP therapy. If not, persistent residual central sleep apnoeas may disturb sleep quality and interfere with compliance, ultimately leading to CPAP intolerance. In this setting, bilevel positive airway pressure ventilation in the spontaneous-timed mode and adaptive servoventilation may prove beneficial. A mandibular advancement device (MAD) would not be expected to prevent central apnoeic events but MADs have been shown to be an effective treatment for OSAS. No randomised studies demonstrating the effectiveness of uvulopalatopharyngoplasty in OSAS or CSA/CSR have been performed.

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HERMES Syllabus link: 5 Treatment modalities and prevention measures, 22 Sleep and control of breathing disorders
Angoff rating: 58%

Question 75

A 65-year-old male presents to you with increasing cough and breathlessness for the past 2 months, weight loss of 7 kg over the same period, two episodes of haemoptysis and increasing fatigue. He is a smoker of 20 cigarettes per day for 40 years. Chest radiography shows a left upper lobe mass with mediastinal widening. Diagnostic work-up shows adenocarcinoma stage IV with cN2 disease and adrenal metastasis. The diagnosis was based on cytology and epidermal growth factor receptor (EGFR)/anaplastic lymphoma kinase (ALK) status are negative. The patient's status is good and no comorbidities are present.
Which one of the following is the appropriate treatment strategy for this patient?

a. Concurrent chemoradiation (platinum/etoposide and thoracic radiotherapy)
b. Chemotherapy with gemcitabine
c. Neoadjuvant chemotherapy (platinum/gemcitabine) followed by surgery
d. Chemotherapy with platinum/pemetrexed
e. Therapy with gefitinib or erlotinib

Correct answer

d. Chemotherapy with platinum/pemetrexed

Nonsmall cell lung cancer (NSCLC) accounts for 80–85% of all lung cancer cases. The major histopathological subtypes are adenocarcinoma, squamous cell carcinoma and large cell carcinoma. Decisions on the treatment strategy should take into account disease, histology, age, performance status, comorbidities and patient preferences. Surgery remains the cornerstone of early-stage (I, II and IIIA) NSCLC treatment, but only in stage I is 5-year survival >50%. There is much room for improvement with systemic adjuvant or neoadjuvant approaches in stages II and III. In patients with stage IIIB or stage IIIA–N2 subset, concomitant chemoradiotherapy at systemic doses results in superior outcome to sequential chemoradiotherapy and is considered the present standard of care. In patients with advanced (stage IV) NSCLC and good performance status, two-drug platinum-based chemotherapy is indicated because of modest gains in survival and improved symptom control and quality of life. Pemetrexed is preferred to gemcitabine in patients with nonsquamous histology according to a survival benefit demonstrated in clinical trials. First-line treatment with a tyrosine kinase inhibitor (erlotinib or gefitinib) is an option but only in patients with tumours harbouring an activating EGFR mutation in exon 19 and/or 21. Finally, single-agent chemotherapy is an alternative option, but only in elderly patients or in patients with poor performance status.

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HERMES Syllabus link: 27 Associated specialties
Angoff rating: 54%

Question 76

What is/are the characteristic(s) common to both nonasthmatic eosinophilic bronchitis and asthma?

a. Airway hyperresponsiveness
b. Good response to corticosteroids
c. Cough
d. Good response to bronchodilators

Correct answers

b. Good response to corticosteroids
c. Cough

Asthma is characterised by eosinophilic airway inflammation that responds well to steroid treatment. Asthma symptoms include dry cough, breathlessness and wheeze. Bronchoconstriction occurs episodically during the disease and can be resolved spontaneously or in response to bronchodilators.
Nonasthmatic eosinophilic bronchitis shares the features of steroid responsiveness and chronic eosinophilic inflammation of the airways causing cough, but it is distinctly different from asthma regarding its lack of airway hyperresponsiveness and bronchoconstriction. This difference is used to discriminate between the two diseases.

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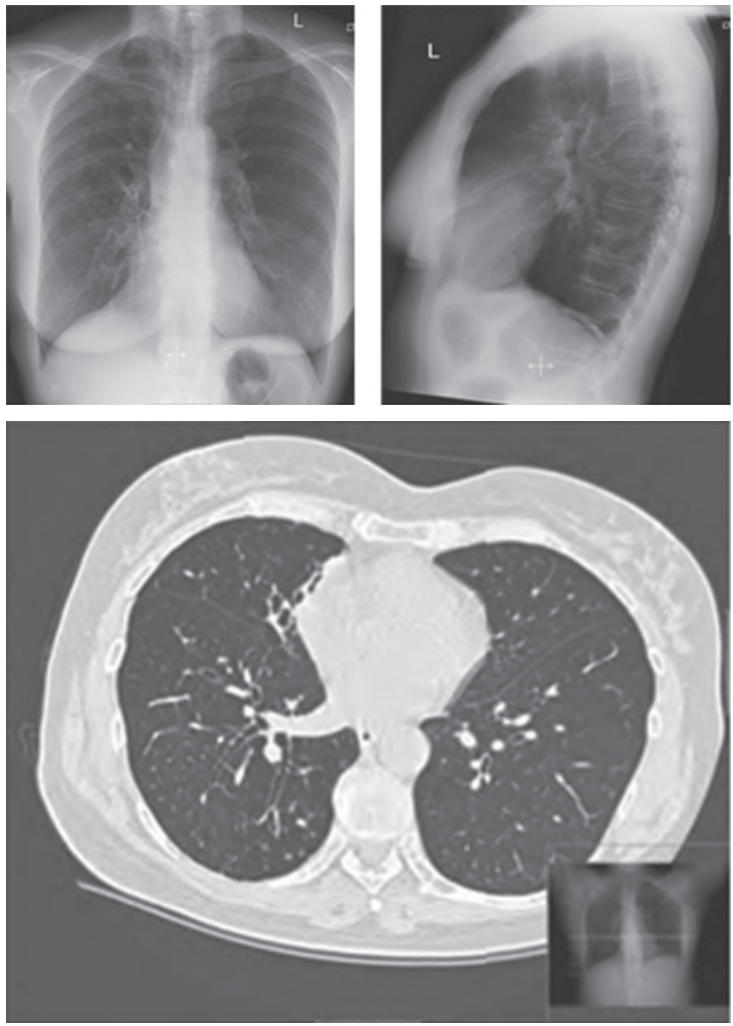
HERMES syllabus link: 6 Airway diseases, 12 Eosinophilic diseases
Angoff rating: 58%

Question 77

A 45-year-old female is referred to you by her general practitioner because she has recurrent episodes (three to six per year) of bronchitis with fever for which she uses courses of antibiotics with good results. Between these episodes, she coughs up phlegm in considerable amounts (several spoonfuls a day). The colour of the phlegm varies from white to yellow; she has never seen blood in her phlegm. She smoked approximately 20 cigarettes per day from the age of 18 years until the age of 30 years. Since then, she has stopped smoking. She has no complaints of shortness of breath, wheezing or tightness of the chest. Her family history is uneventful. Her flow–volume curve was normal. Her chest radiograph and CT are shown below.



Which one of the following is the most appropriate next action?

a. Lung resection surgery
b. Inhaled bronchodilators
c. Bronchoscopy
d. Maintenance antibiotic therapy with quinolones
e. Sputum culture

Correct answer

e. Sputum culture

The history and the CT are consistent with bronchiectasis. Surgery is not an option because conservative treatment options have to be optimised first. As the spirometry result is normal, bronchodilators are not indicated. In patients with airflow obstruction, reversibility to β-adrenergic and anticholinergic bronchodilators should be tested, and therapy initiated if lung function or symptoms improve on therapy. Bronchoscopy might be useful if there is haemoptysis, to localise the source of bleeding, but this examination is not currently necessary in this patient. Three recently published randomised, double-blind, placebo-controlled studies showed that low-dose macrolides (azithromycin or erythromycin) taken for 6–12 months led to significant reductions in exacerbation rate and reduced the decline in lung function. In all studies, macrolides were generally well tolerated. The advantages of macrolide maintenance therapy need to be balanced against the risks, which include emergence of bacterial resistance, cardiotoxicity and ototoxicity. Long-term quinolones should not be used until further studies are available. Apart from infection, bronchiectasis may be due to several specific causes, such as cystic fibrosis, antibody deficiency syndromes and immotile cilia. Therefore, these diagnoses should be evaluated by performing a sweat test and measuring immunoglobulin levels. Furthermore, sputum samples should be investigated for particular microorganisms including mycobacteria and resistant bacteria.

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HERMES Syllabus link: 6 Airway diseases
Angoff rating: 63%

Question 78

A 36-year-old immunocompetent male is admitted to the hospital with symptoms of recurrent fever, cough, and anorexia and weight loss. Admission baseline investigations show normal renal and liver function tests. A chest radiograph shows patchy infiltrates and cavitations in the right and left upper lobe. Microbiological and molecular tests in sputum are positive for *Mycobacterium tuberculosis*. Initial molecular drug resistance testing of mutations associated with rifampicin and isoniazid resistance were negative.
Which one of the following is the recommended treatment for this patient?

a. Isoniazid, rifampicin, ethambutol and pyrazinamide for 2 months, followed by isoniazid and rifampicin for 4 months
b. Isoniazid, rifampicin, ethambutol and pyrazinamide for 6 months
c. Isoniazid, rifampicin, ethambutol, streptomycin and pyrazinamide for 2 months, followed by rifampicin and isoniazid for 7 months
d. Isoniazid, rifampicin, ethambutol for 6 months
e. Isoniazid, rifampicin, ethambutol and pyrazinamide for 2 months, followed by rifampicin, isoniazid and ethambutol for 4 months

Correct answer

a. Isoniazid, rifampicin, ethambutol and pyrazinamide for 2 months, followed by isoniazid and rifampicin for 4 months

Tuberculosis (TB) is an infectious disease caused by *M. tuberculosis*. The World Health Organization (WHO) estimates that 9.27 million new cases of TB occurred in 2007 and of them 44% were infectious (new pulmonary sputum smear-positive cases). Sputum smear microscopy is still the most widely used technique for the diagnosis of pulmonary TB. Drug susceptibility testing using molecular techniques can enhance TB diagnosis and help physicians to choose the appropriate treatment. Due to their higher bacillary burden, individuals with active, smear-positive TB are the main source of TB transmission in the community. The highest priority in TB control programmes is the rapid identification of these cases and effective treatment. The WHO and CDC recommends that for patients in whom TB is proved or strongly suspected, treatment should be initiated with isoniazid, rifampicin, pyrazinamide and ethambutol for the initial 2 months. A repeat smear and culture should be performed after 2 months of treatment have been completed. If cavities were seen on the initial chest radiograph or the acid-fast smear is positive at completion of 2 months of treatment, the continuation phase of treatment should consist of isoniazid and rifampicin daily or twice weekly for 4 months to complete a total of 6 months of treatment. If cavitation was present on the initial chest radiograph and the culture at the time of completion of 2 months of therapy is positive, the continuation phase should be lengthened to 7 months (total of 9 months of treatment). Although clinical trials have shown that the efficacy of streptomycin is approximately equal to that of ethambutol in the initial phase of treatment, the increasing frequency of resistance to streptomycin globally has made the drug less useful. Thus, streptomycin is not recommended as being interchangeable with ethambutol.

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HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 70%

Question 79

In a patient with left ventricular failure, of which of the following phenomena during sleep is a low waking P_{aCO_2} (<4.7 kPa (<35 mmHg)) predictive?

a. Reduced sympathetic activity
b. Central sleep apnoea
c. Obstructive sleep apnoea–hypopnoea
d. Progressive hypocapnia during the night
e. Prolonged periods (>5 min) of arterial desaturation

Correct answer

b. Central sleep apnoea

Left ventricular failure is associated with increased sympathetic activity and a low P_{aCO_2} value is predictive of central sleep apnoea rather than obstructive sleep apnoea–hypopnoea. P_{aCO_2} may fall below the apnoeic threshold during sleep but will rise again during the resultant apnoea so that progressive hypocapnia does not occur. Prolonged periods of arterial desaturation are not usually seen in central sleep apnoea because recurrent arousals return S_{aO_2} to near-waking levels, but are more typical of nocturnal hypoventilation.

Reference

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HERMES Syllabus link: 1 Structure and function of the respiratory system, 22 Sleep and control of breathing disorders
Angoff rating: 57%

Question 80

A 72-year-old patient with very severe COPD has been on long-term home oxygen therapy for 5 years. He suffers from recurrent exacerbations, which can usually be managed on an outpatient basis. Recently he was admitted to the hospital due to respiratory failure.
Which of the following statements is false?

a. Patients with very severe COPD should not be put on invasive ventilation because the probability that they can be extubated and discharged from hospital is low.
b. The decision to admit a patient with advanced COPD to the intensive care unit (ICU) should be based more on the patient's quality of life and his will to live than on the severity of the disease.
c. Patients with respiratory failure due to COPD exacerbation should primarily be treated with NIV.
d. Patients suffering from very severe COPD who have been ventilated in an ICU due to respiratory failure have a lower 5-year survival rate compared with patients with the same disease severity who have not undergone mechanical ventilation during an exacerbation.
e. Recurrent exacerbations in patients who have been previously treated in an ICU are often due to Gram-negative bronchial infections.

Correct answer

a. Patients with very severe COPD should not be put on invasive ventilation because the probability that they can be extubated and discharged from hospital is low.

Exacerbation of very severe COPD is a life-threatening condition. It may lead to acute respiratory failure superimposed on pre-existing chronic respiratory failure. The first-line treatment of these patients is ventilatory support. If tolerated, NIV is the preferred mode; however, in some patients, invasive ventilation cannot be avoided without risking the life of the patient. In very severe COPD, the decision to start mechanical ventilation is mainly based on the advanced directives, learning the patient's wishes, assessing his/her quality of life and consulting family members. Those patients who require mechanical ventilation due to COPD exacerbation have lower 5-year life expectancy than patients who do not need ventilation. Mechanical ventilation for acute respiratory failure in patients with COPD is associated with high rates of ICU mortality (37–64% percent) but, nevertheless, this treatment is not futile.

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HERMES Syllabus link 6: Airway diseases, 18 Respiratory failure, 27 Associated specialties
Angoff rating: 62%

Question 81

A 24-year-old medical student is consulting you before departing to Africa where he plans to climb Mt Kilimanjaro (5895 m). Apart from seasonal allergic rhinitis, his medical history is unremarkable and he is physically very fit. He asks for your advice regarding prevention of altitude-related illness. You recommend a gradual ascent not exceeding 300–500 m every 24 h above 2500 m, avoidance of physical overexertion and a low sleeping altitude if feasible. The student asks you to prescribe a drug for prevention of acute mountain sickness.
Which one of the following is the most appropriate?

a. Acetazolamide
b. Furosemide
c. Nifedipine
d. Sildenafil
e. Theophylline

Correct answer

a. Acetazolamide

Altitude-related illnesses can be divided into acute and chronic forms. Chronic mountain sickness occurs in long-term residents at altitudes >3000 m. Acute forms include acute mountain sickness (AMS), high-altitude cerebral oedema and high-altitude pulmonary oedema. AMS is quite common in newcomers at altitudes >3000 m. About 60% of climbers reaching the top of Mt Kilimanjaro suffer from AMS. Symptoms start within 6–12 h after arrival at altitude and comprise headaches, fatigue, weakness, loss of appetite, nausea and insomnia. Severe headaches resistant to nonsteroidal antirheumatics, ataxia and progressively altered consciousness in a subject suffering from AMS are signs of impeding high-altitude cerebral oedema, a life-threatening condition. High-altitude pulmonary oedema is much less common than AMS. It occurs in susceptible subjects at altitudes >3000 m within a few hours to 3 days. Affected subjects suffer from excessive dyspnoea, cough with our without sputum production, severe cyanosis and, sometimes, elevated body temperature. Acute altitude-related illnesses may be prevented by a gradual ascent not exceeding 300–600 m every 24 h above 2500 m allowing enough time for acclimatisation, avoidance of extreme physical exertion, a low sleeping altitude and drugs. Pharmacological prevention of AMS may be performed by acetazolamide (2 times 125 to 250 mg per day) or dexamethasone (2 times 4 mg per day), starting 24 h before ascent. Furosemide does not prevent altitude-related illness and should not be taken at altitude to avoid dehydration. Nifedipine and sildenafil reduce pulmonary artery pressure at high altitude and may be used to prevent high-altitude pulmonary oedema. They have no role in prevention or treatment of AMS. Theophylline reduces high-altitude periodic breathing but is not recommended for prevention of AMS.

References

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HERMES Syllabus link: 16 Environmental diseases
Angoff rating: 58%

Question 82

Which one of the following statements regarding post-operative outcome and prognosis in nonsmall cell lung cancer is incorrect?

a. Outcome of surgery depends on the procedure volume of a hospital.
b. Lobectomy should be preferred over pneumonectomy if complete resection is possible with lobectomy.
c. Segmentectomy may be an acceptable alternative to lobectomy in high-risk patients with tumours <2 cm in diameter.
d. Formal lymph node dissection increases the post-operative complication rate compared with selective sampling.
e. Tumour location in different lobes may be an indication for pneumonectomy or bilobectomy with curative intent.

Correct answer

d. Formal lymph node dissection increases the post-operative complication rate compared with selective sampling.

Principles of surgical treatment for nonsmall cell lung cancer include complete anatomic resection and complete lymph node dissection. The best results are obtained by well-trained specialised thoracic surgeons working in high-volume units. Procedure volume not only affects early outcome but even long-term survival.

Basic principles issued by a working group of the French Society for Thoracic and Cardiovascular Surgery opt for a complete anatomic resection including precise hilar dissection, according to the loco-regional extent of the tumour. Lobectomy is preferred over pneumonectomy whenever it enables a complete resection. Lobectomy is not possible if the tumour extends across the fissure, invades the main pulmonary artery or involves the bronchial tree proximal to the lobar root. A tumour located in different lobes is an indication for pneumonectomy or a bilobectomy. Lobectomy is preferred to pneumonectomy because of its substantially lower peri-operative risk. Routinely, it is not recommended to resect less tissue than a pulmonary lobe; however, recent evidence suggests a place for segmentectomy in high-risk patients with tumours <2 cm and even wedge excisions in very small bronchoalveolar carcinoma presenting as ground-glass opacities.

Complete homolateral lymph node dissection is important for staging. Leaving unrecognised lymph node metastases is a risk for local recurrence. Formal lymph node dissection does not increase the post-operative complication rate compared with sampling.

References

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HERMES Syllabus link: 27 Associated specialties
Angoff rating: 60%

Question 83

A 34-year-old man has pulmonary tuberculosis with the lung lesion confined to the left upper lobe, where there is a 3-cm cavity with extensive interstitial infiltration. He has had haematuria and pyuria for 4 weeks, and an intravenous pyelogram shows deformed collecting structures in the upper pole of the left kidney. Sputum and urine cultures are positive for *Mycobacterium tuberculosis*. A serum test for HIV infection is negative.
Which one of the following is the treatment regimen of choice for this patient?

a. Isoniazid and rifampicin daily for 9 months
b. Isoniazid and rifampicin daily for 12 months
c. Isoniazid, rifampicin and ethambutol daily for 9 months
d. Isoniazid, rifampicin, pyrazinamide and ethambutol daily for 2 months, followed by rifampicin and isoniazid daily for 4 months
e. Isoniazid and rifampicin daily, together with streptomycin five times weekly for 2 months, followed by isoniazid and rifampicin daily for 10 more months

Correct answer

d. Isoniazid, rifampicin, pyrazinamide and ethambutol daily for 2 months, followed by rifampicin and isoniazid daily for 4 months

The British Thoracic Society guideline on tuberculosis recommends a 6-month, four-drug initial regimen (6 months of isoniazid and rifampicin, supplemented in the first 2 months with pyrazinamide and ethambutol) to treat active respiratory tuberculosis in adults not known to be HIV positive, adults who are HIV positive and children. The reason for using four drugs in the initial phase is that, in most cases, the resistance pattern will not be known.
The addition of pyrazinamide in the initial phase (2 months) results in quicker sputum conversion and allows the reduction of the total treatment period from 9 to 6 months. The recommended regimen for renal tuberculosis is the same as for pulmonary tuberculosis.

Reference

National Institute for Health and Care Excellence. Tuberculosis: clinical diagnosis and management of tuberculosis, and measures for its prevention and control. www.nice.org.uk/guidance/cg117 Date last updated: March 2011.

HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 68%

Question 84

A 24-year-old female is visiting your outpatient clinic for regular follow-up of her asthma. You have known this patient for 7 years because she has allergic asthma (allergies to house dust mites, grass and tree pollen). During the pollen season, she has only minor complaints of intermittent allergic rhinitis, for which she uses an antihistamine as needed. At the age of 17 years, she was admitted to the hospital because of a severe asthma attack. Since then, she has been followed up regularly. Her last check-up was 3 months ago. She was stable at that time. Therefore, you reduced her medication from budesonide/formoterol 200/6 µg twice a day to budesonide/formoterol 200/6 µg once in the morning. Since then, she has remained completely asymptomatic both in the daytime and at night. She plays tennis twice a week without any problems. She has used her terbutaline only twice during the past 3 months because she felt so well.
According to the Global Initiative for Asthma management strategy, what would be the most appropriate next action?

a. Continue budesonide/formoterol 200/6 µg once a day for a total of 6 months, if the patient is stable, then stop and prescribe terbutaline as needed.
b. Continue budesonide/formoterol 200/6 µg once a day and as reliever medication as needed, and schedule a follow up visit in 1 month.
c. Stop the budesonide/formoterol, prescribe terbutaline as needed, schedule an appointment in 1 month.
d. Switch to budesonide 200 µg once a day and terbutaline as needed, schedule a further appointment in 3 months.
e. Switch to monotherapy formoterol 6 µg once a day and as needed and schedule a follow up visit in 1 month.

Correct answer

d. Switch to budesonide 200 μg once a day and terbutaline as needed, schedule a further appointment in 3 months.

According to the new 2015 Global Initiative for Asthma management strategy, the inhaled corticosteroids (ICS)/long-acting β_2-agonist (LABA) should be reduced to once daily low-dose ICS/LABA (*i.e.* 200–400 μg once a day). Once good asthma control has been achieved and maintained for 3 months, and lung function has reached a plateau, a further reduction in therapy can be considered (discontinuation of the LABA and the change of the reliever medication to a short-acting β_2-agonist while keeping the ICS). Complete cessation of ICS in adults is not advised as the risk of exacerbations is increased. In addition, low-dose budesonide/formoterol is the recommended reliever medication for patients prescribed low-dose budesonide/formoterol. Stopping the controller treatment in stable asthma is considered to be inappropriate.

References

Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention. www.ginasthma.org/local/uploads/files/GINA_Report_2015_May19.pdf Date last updated: May 19, 2015.

Rank MA, *et al.* The risk of asthma exacerbation after stopping low-dose inhaled corticosteroids: a systematic review and meta-analysis of randomized controlled trials. *J Allergy Clin Immunol* 2013; 131: 724–729.

HERMES Syllabus link: 6 Airway diseases
Angoff rating: 42%

Question 85

A 26-year-old man with cystic fibrosis presents because of increasing dyspnoea and cough following recurrent episodes of chest infections. He has required frequent hospitalisation for intravenous antibiotics and vigorous chest physiotherapy. Previous sputum cultures revealed *Pseudomonas aeruginosa* sensitive to gentamicin, tobramycin and ciprofloxacin, but resistant to imipenem and other antibiotics. 2 months ago, his FVC was 1.6 L (45% predicted) and his FEV_1 was 0.6 L (30% predicted). 4 months ago, he had a left-sided pneumothorax requiring chest tube insertion. During a routine follow-up visit 14 months ago, his FVC was 2.3 L (55% predicted) and FEV_1 was 1.1 L (45% predicted). The patient is highly motivated and compliant with medications, twice-daily chest physiotherapy, and follow-up visits. He and his family members attribute his recent deterioration to depression because his girlfriend left him several months ago.
At this time, for which of the following should the patient be referred?

a. Counselling and pulmonary rehabilitation
b. Prophylactic pleurodesis on the left side
c. Single-lung transplantation on the right side
d. Bilateral lung transplantation
e. Hospice care and continued frequent follow-up

Correct answer

d. Bilateral lung transplantation

This is a young cystic fibrosis patient with rapid, progressive respiratory deterioration despite excellent compliance. Both FEV_1 ≤30% predicted and rapid progressive deterioration are criteria for transplantation. There is no absolute contraindication for transplantation indicated in this case. The depression does not interfere with compliance and could be treated.

While a review showed improvements in exercise capacity, strength and quality of life after exercise training, with some evidence of a slower decline in lung function, these effects are not consistent across trials. Because of the FEV_1 and its rapid decline, pulmonary rehabilitation is not a sufficient approach.

There is no indication of current pneumothorax and prophylactic pleurodesis would cause his current status to deteriorate. The history of recent pneumothorax does not exclude transplantation.

While single-lung transplantation is advantageous to organ allocation, especially in COPD, it is not an option in patients with cystic fibrosis, who tend to have chronic infections of their lungs. Hospice care and frequent follow-up are indicated if all therapeutic options are exhausted. In this patient transplantation would be the treatment of choice.

References

Kreider M, *et al.* Selection of candidates for lung transplantation. *Proc Am Thorac Soc* 2009; 6: 20–27.

Spruit MA, *et al.* An official American Thoracic Society/European Respiratory Society statement: key concepts and advances in pulmonary rehabilitation. *Am J Respir Crit Care Med* 2013; 188: e13–e64.

The American Society for Transplant Physicians, *et al.* International guidelines for the selection of lung transplant candidates. *Am J Respir Crit Care Med* 1998; 158: 335–367.

Weill D, *et al.* A consensus document for the selection of lung transplant candidates: 2014 – an update from the pulmonary transplantation council of the international society for heart and lung transplantation. *J Heart Lung Transplant* 2015; 34: 1–15.

HERMES Syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases, 26 Genetic and developmental disorders
Angoff rating: 59%

Question 86

A 43-year-old male complains of sudden bilateral chest pain, aggravated by inspiration, and accompanied by malaise and slight fever. Physical examination shows some tenderness on both sides of the chest but normal breath sounds. His chest radiograph appears normal but ultrasound reveals small bilateral pleural effusions. The patient reports that 1 week ago, one of his children was admitted to the hospital with acute meningitis.
Which of the following is the most likely microorganism causing his illness?

a. Varicella–zoster virus
b. Coxsackievirus B
c. Influenza virus
d. Epstein–Barr virus
e. Adenovirus

Correct answer

b. Coxsackie virus B

This patient's history and the simultaneous diagnosis of meningitis in his child point to an infectious disease. Bilateral chest pain aggravated by breathing movements is typical of epidemic pleurodynia (also known as Bornholm disease or epidemic myalgia), which is often caused by coxsackievirus B infection. The pain is usually caused by involvement of the intercostal muscles. The disease can be accompanied by headache, pleuritis, meningitis and myocarditis. Analgesics, narcotics and heating pads are the mainstays of therapy. Patients generally recover completely within 1 week.

References

Hind M. Chest pain. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 59–60.

Ikeda RM, *et al.* Pleurodynia among football players at a high school. An outbreak associated with coxsackievirus B1. *JAMA* 2013; 270: 2205–2206.

HERMES Syllabus link: 7 Infectious disease
Angoff rating: 49%

Question 87

A 66-year-old male with a history of hypertension is hospitalised for colon cancer surgery. He undergoes a successful subtotal colectomy and ileocolic anastomosis, without any signs of complication. His immediate post-operative state is good, but on post-operative day 4 he develops sudden-onset shortness of breath and also has two episodes of haemoptysis. His blood pressure is 130/70 mmHg; his pulse is regular, with a rate of 110 beats per min and his respiratory rate is 28 breaths per min. His temperature is normal and his S_{pO_2} is 88% on room air, which improves to 95% on 2 L per min of oxygen *via* nasal cannula. He has mildly decreased breath sounds at his left lung base and a normal S1 and S2 without murmurs or gallops. His abdomen is soft and non-tender with normal bowel sounds. The patient does not have any oedema or tenderness in the lower extremities.

The laboratory analyses, including a complete blood cell count and basic metabolic panel, are normal. Arterial blood gas analysis on room air demonstrates a P_{aO_2} of 7.28 kPa (56 mmHg), a P_{aCO_2} of 3.99 kPa (30 mmHg), and a pH of 7.48, with an S_{pO_2} of 90%. Chest radiography reveals left basilar segmental atelectasis. The ECG shows tachycardia of 116 beats per min and a right bundle branch block, which is a new finding for this patient.

Which of the following is the next diagnostic test in order to confirm your diagnosis in this patient?

a. Plasma D-dimer levels
b. Perfusion lung scan, using the chest radiograph as a surrogate for the ventilation study
c. Multidetector CT pulmonary angiography
d. Lower limb compression venous ultrasonography (CUS)
e. Echocardiography

Correct answer

c. Multidetector CT pulmonary angiography

In this case, a presumptive diagnosis of pulmonary embolism (PE) has to be made on the basis of the patient's medical history, physical findings and the ECG findings.
PE is a relatively common condition that affects all age-groups and can potentially be lethal. Early diagnosis is crucial, since immediate treatment is highly effective. Several clinical prediction rules are available for the diagnosis of PE. Two of these, the Wells score and the Revised Geneva score, have been widely used and validated in diagnostic studies (table). Whichever rule is used, the prevalence of confirmed PE is approximately 10% in the low, 30% in the moderate and 70% in the high probability category. This patient has a high clinical probability of PE according to both scores.

Table The Wells and Revised Geneva scores

Wells score		**Revised Geneva score**	
Variable	**Points**	**Variable**	**Points**
Deep vein thrombosis symptoms (DVT)/signs	3.0	Age >65 years	1
PE at least as likely as another diagnosis	3.0	Active cancer	2
Heart rate >100 beats per min	1.5	Haemoptysis	2
Immobilisation or surgery in past 4 weeks	1.5	Previous DVT or PE	3
Previous DVT or PE	1.5	Surgery or lower limb fracture in past 1 month	2
Haemoptysis	1.0	Lower limb unilateral oedema and pain at palpation	4
Cancer	1.0	Spontaneously reported calf pain	3
		Heart rate 75–94 beats per min	3
		Heart rate ≥95 beats per min	5
Pre-test probability of pulmonary embolism	**Total score**	**Pre-test probability of pulmonary embolism**	**Total score**
Low (2–6%)	<2	Low (7–12%)	≤3
Intermediate (17–24%)	2–6	Intermediate (22–31%)	4–10
High (54–78%)	≥7	High (58–82%)	≥11

Another important issue is to assess the severity of the suspected PE. PE can be stratified into several levels of risk of early death, based on the presence of risk markers. Immediate bedside clinical assessment for the presence or absence of clinical markers such as shock or hypotension allows stratification into high-risk and non-high-risk PE. This classification helps in the choice of the optimal diagnostic strategy and initial management. This patient must be classified in the non-high-risk group of suspected PE. The diagnostic algorithm used to confirm or exclude PE in this patient is presented in the figure.
The 2008 European Society of Cardiology guidelines on the diagnosis and management of acute pulmonary embolism (freely available online) contain a diagnostic algorithm that can be used to confirm or exclude PE in this patient. D-dimer measurement should be restricted to patients with a low or intermediate clinical probability of PE. D-dimer should not be measured in patients with a high clinical probability, because of its low negative predictive value in this population. It is also less useful in hospitalised patients.

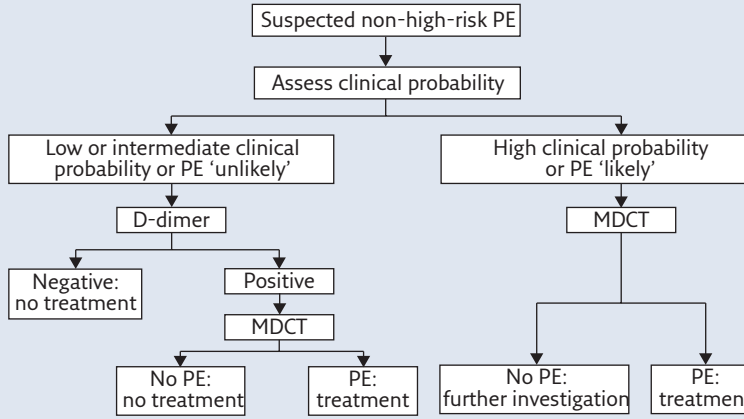

FIGURE. Proposed diagnostic algorithm for patients with suspected non-high-risk PE. MDCT: multidetector computed tomography. Reproduced from Torbicki *et al*. (2008), with permission from the publisher.

Ventilation/perfusion scintigraphy remains a valid option in the diagnostic algorithm of PE, especially in patients with a contraindication to CT. But in many countries, only the perfusion phase is performed in clinical practice and chest radiography is used as a surrogate for the ventilation study. This is not a preferred strategy when the perfusion scan is not normal, but may be acceptable in patients with normal chest radiograph.

CUS is used as an indirect method to diagnose PE. CUS can be used either as a backup procedure to reduce the overall false-negative rate when using single-detector CT or it can be performed to avoid CT when positive in patients with contraindications to CT.

Echocardiography is particularly helpful in emergency management decisions, in patients with suspected PE who are in a critical condition. In a patient with shock or hypotension, the absence of echocardiographic signs of right ventricular overload or dysfunction practically excludes PE as a cause of haemodynamic compromise. But systematic use of echocardiography for diagnosis in haemodynamically stable, normotensive patients is not recommended.

CT angiography has become the main thoracic imaging test for investigating suspected PE. Multidetector CT angiography (MDCT) is the first-line test in patients with a high clinical probability and the second-line test in patients with an elevated D-dimer level.

References

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Torbicki A, *et al.* Guidelines on the diagnosis and management of acute pulmonary embolism: the Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC). *Eur Heart J* 2008; 29: 2276–2315.

HERMES Syllabus link: 14 Pulmonary vascular diseases
Angoff rating: 67%

Question 88

Which of the following organisms is least likely to be part of the upper respiratory flora?

a. *Streptococcus pneumoniae*
b. *Haemophilus influenzae*
c. *Escherichia coli*
d. *Legionella pneumophila*
e. *Bacteroides fragilis*

Correct answer

d. *Legionella pneumophila*

Pneumonia due to *S. pneumoniae*, *H. influenzae* or *E. coli* is due to microaspiration from the oropharynx; thus, these bacteria may colonise the upper airways. *B. fragilis* is an anaerobic bacterium that can be found in the upper airways and can result in lung infection in cases of macroscopic aspiration. *Legionella* infection usually occurs through inhalation of contaminated aerosols produced by water systems such as cooling towers, showers, hot water distribution systems and taps. Consequently, *Legionella* is the least likely to colonise the upper airways.

Reference

Carratalà J, *et al*. An update on *Legionella*. *Curr Op Infect Dis* 2010; 23: 152–157.

HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 66%

Question 89

Which of the following statements about lung cancer treatment is/are correct?

a. Patients with small cell lung cancer with response to chemotherapy should be offered prophylactic cranial irradiation, unless they have a poor performance status or mental impairment.
b. In patients with advanced adenocarcinoma and haemoptysis, bevacizumab is recommended.
c. In patients with advanced squamous cell cancer and good performance status, a platinum doublet therapy is recommended.
d. In stage IIIB nonsmall cell lung cancer in fit patients, preferred management is sequential chemoradiotherapy.

Correct answer

a. Patients with small cell lung cancer with response to chemotherapy should be offered prophylactic cranial irradiation, unless they have a poor performance status or mental impairment.

c. In patients with advanced squamous cell cancer and good performance status, a platinum doublet therapy is recommended.

National Comprehensive Cancer Network guidelines suggest that in complete or partial response to initial therapy of small cell lung cancer, prophylactic cranial irradiation is indicated, unless the patient has poor performance status or impaired mental function.

Bevacizumab blocks the vascular endothelial growth factor and is a recommended option for fit patients (World Health Organization/Eastern Cooperative Oncology Group stage 0–1) with non-squamous cell carcinoma who are EGFR negative. Bevacizumab can cause severe haemorrhage and should not be used in patients with central tumours and haemoptysis.

Platinum-based therapy prolongs survival and improves symptom control and quality of life in nonsmall cell lung cancer patients. Two drug regimens are preferred. A third drug improves response rate, but not survival. In squamous cell carcinoma, the gemcitabin/cisplatin combination shows superior efficacy compared with pemetrexed/cisplatin. Other options include platinum combinations with paclitaxel, docotaxel, vinorelbine, vinblastine and others.

Concurrent chemoradiotherapy has been shown to produce better results and should be given in fit patients. In unfit patients, a sequential approach should be chosen.

References

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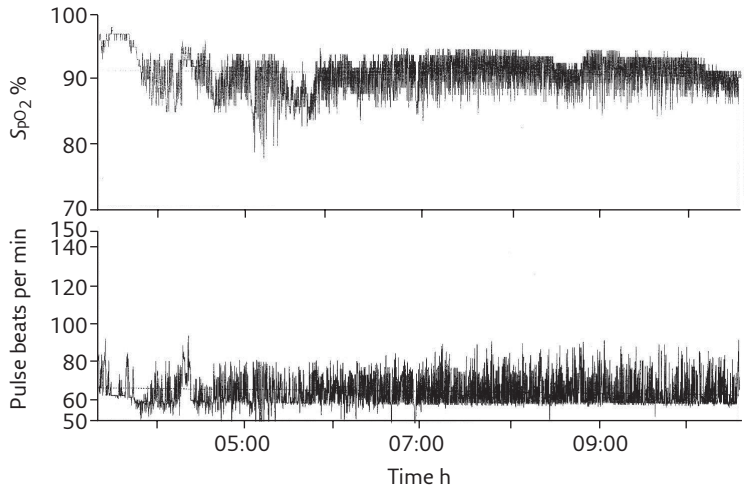
Jett JR, *et al.* Treatment of small cell lung cancer: diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2013; 143: Suppl., e400S–e419S.

HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 55%

Question 90

A 71-year-old male is referred to you for evaluation of heavy snoring, daytime sleepiness, increasing shortness of breath, chronic cough and fatigue. His height is 184 cm, his weight is 106 kg and his oxygen saturation on room air at rest is 91%. His blood pressure is 160/90 mmHg, and heart rate is 96 beats per min and irregular. ECG shows atrial fibrillation. He regularly inhales ipratropium bromide for his COPD (Global Initiative for Chronic Obstructive Lung Disease grade 2). He smokes 20 cigarettes per day (total of 50 pack-years), drinks a bottle of wine every evening and takes 2.5 mg of temazepam before sleep because of frequent awakening with shortness of breath. The results of night-time pulse oximetry are shown in the below.



Regarding the further management of this patient, which one of the following statements is wrong?

a. Weight reduction and avoidance of alcohol and sedatives are important adjunctive measures for the treatment.
b. Acetazolamide is a treatment option in this patient because it improves respiratory centre drive.
c. It should be noted in the medical record that the patient has been advised not to drive a car.
d. Anatomic upper airway obstruction has to be ruled out because in certain cases, surgical measures can significantly improve severe sleep apnoea syndrome.
e. Hypothyroidism has to be ruled out.

Correct answer

b. Acetazolamide is a treatment option in this patient because it improves respiratory centre drive.

The features of snoring, sleepiness, breathlessness, history of heavy smoking, reduced waking S_{aO_2} and recurrent dips in saturation overnight are consistent with a combination of obstructive sleep apnoea–hypopnoea syndrome and COPD, sometimes known as the overlap syndrome. Alcohol and nocturnal sedation reduce ventilatory drive and make sleep disordered breathing worse. Acetazolamide increases ventilatory drive but this will not resolve the obstructive sleep apnoea–hypopnoea or COPD, which require treatment with CPAP, or NIV if nocturnal hypercapnia occurs.

Weight loss and avoidance of alcohol and nocturnal sedation should be advised, and it should be noted in records that the patient with sleepiness has been advised not to drive until sleepiness is resolved by therapy. Anatomical upper airway obstruction (*e.g.* large tonsils) may contribute to the development of OSA and so should be excluded by upper airway examination but is unlikely to be a major factor in this case. Hypothyroidism is associated with an increased incidence of OSA but correction of thyroxine levels may not eliminate OSA and should not delay therapy such as CPAP if OSA is moderate or severe.

Reference

Weitzenblum E, *et al.* Overlap syndrome. *Proc Am Thorac Soc* 2008; 5: 237–241.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 60%

Question 91

To which of the following patients is the chest CT shown below most likely to belong?

a. 79-year-old, nonsmoking female with metastatic breast cancer
b. 34-year-old, female smoker with Langerhans' cell histiocytosis
c. 56-year-old, male smoker with pneumococcal pneumonia
d. 55-year-old, male bird-fancier with hypersensitivity pneumonitis
e. 63-year-old male with congestive heart failure

Correct answer

d. 55-year-old, male bird-fancier with hypersensitivity pneumonitis

The CT image shows bilateral, diffuse, poorly defined, micronodular opacities ('miliary' pattern) that are consistent with hypersensitivity pneumonitis. Metastatic breast cancer can also be associated with a diffuse micronodular pattern (lymphangitic carcinomatosis) but the micronodular opacities are much better defined.

The CT lung pattern is different in the other three diseases. In Langerhans' cell histiocytosis, there are typical cystic lesions associated with pulmonary nodules. Pneumococcal pneumonia typically shows lobar and sometimes multilobar alveolar consolidation. Congestive heart failure presents with an interstitial pattern including Kerley B lines, apical vascular redistribution and, in more severe cases, a butterfly-like bilateral consolidation consistent with pulmonary oedema.

References

Mohr LC. Hypersensitivity pneumonitis. *Curr Opin Pulm Med* 2004; 10: 401–411.

Glazer CS *et al*. Clinical and radiologic manifestations of hypersensitivity pneumonitis. *J Thorac Imaging* 2002; 17: 261–272.

HERMES Syllabus link: 10 Interstitial lung disease, 15 Occupational diseases
Angoff rating: 66%

Question 92

A 67-year-old man with a previous history of myocardial infarction has dyspnoea after climbing one set of stairs. He generally feels tired but does not fall asleep during the daytime (Epworth Sleepiness Scale score 8). His BMI is 25 $kg \cdot m^{-2}$. He is on a diuretic, a statin and aspirin but no other medication. His left ventricular ejection fraction was 34% 2 years ago when the patient was admitted with dyspnoea and pulmonary oedema. As his wife reports snoring, an ambulatory polygraphy is performed. The results are: AHI 26 events per h, central AHI 17 events per h, lowest S_{pO_2} 83%, S_{pO_2} <90% for 5% of time in bed.
What is the most appropriate next step?

a. Treat the patient with adaptive servoventilation if polysomnography confirms the results of the polygraphy.
b. Treat the patient with CPAP if polysomnography confirms the results of the polygraphy.
c. Treat the patient with nasal oxygen if polysomnography confirms the results of the polygraphy.
d. Intensify the heart failure medication by using a β-blocker and/or angiotensin-converting enzyme inhibitor.
e. At present, no therapy is needed, but in 1 year, the patient should come back to your clinic again.

Correct answer

d. Intensify the heart failure medication by using a β-blocker and/or angiotensin-converting enzyme inhibitor.

The patient has left ventricular failure with predominantly central sleep apnoea. The first step is to optimise therapy for heart failure so a β-blocker and angiotensin-converting enzyme inhibitor should be added according to heart failure guidelines. Improvement in heart function may improve sleep disordered breathing and the patient should be reassessed with a further sleep study after the heart failure therapy has been optimised. If symptomatic central sleep apnoea (CSA) persists, CPAP is not recommended and oxygen therapy has not demonstrated long-term benefit. Adaptive servoventilation should not be recommended in a patient with CSA and a low ejection fraction.

References

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HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 55%

Question 93

A 27-year-old, previously healthy female presents with acute onset of dyspnoea and coughing spells with blood-tinged sputum. Chest radiography shows extensive bilateral opacities. The patient is hypoxic on room air (S_{pO_2} 84%). Sequential bronchoalveolar lavage reveals progressively bloodier fluid return. You decide to look for an autoimmune disease.
Which one of the following anti-body panels is <u>least</u> likely to confirm the diagnosis?

a. Anti-double stranded DNA antibody and anti-histone antibody
b. Anti-Scl antibody (scleroderma) and anti-phospholipid antibody
c. Anti-neutrophil cytoplasm antibody (ANCA) and anti-cyclic citrullinated polypeptide antibody
d. Anti-nuclear antibody and ANCA
e. Anti-glomerular basement membrane antibody and anti-smooth muscle protein antibody

Correct answer

b. Anti-Scl antibody (scleroderma) and anti-phospholipid antibody

The patient suffers from a diffuse alveolar haemorrhage (DAH). The most likely causes for DAH in combination with an autoimmune disease include ANCA-associated diseases, such as granulomatosis with polyangiitis and microscopic polyangiitis, Goodpasture syndrome (associated with anti-glomerular basement membrane antibodies) and systemic lupus erythematosus (associated with anti-double stranded DNA antibody). Anti-Scl antibody and anti-phospholipid antibody syndromes are very rare causes of DAH.

Reference

Lara AR, *et al.* Diffuse alveolar hemorrhage. *Chest* 2010; 137: 1164–1171.

HERMES Syllabus link: 13 Respiratory consequences of systemic/extrapulmonary disorders, 14 Pulmonary vascular diseases, 24 Immunodeficiency disorders
Angoff rating: 48%

Question 94

The introduction of inhaled long-acting β-adrenergic agonists (LABAs) in asthma therapy may have adverse effects.
In which of the following situations can the introduction of LABAs be expected to provide benefits that outweigh the potential harmful effects?

a. Uncontrolled asthma according to GINA guidelines with 400 µg of daily budesonide
b. Asthma partially controlled with a leukotriene antagonist
c. In allergic asthma partially controlled with 1000 µg fluticasone-propionate daily
d. In difficult-to-treat asthma on systemic and inhaled corticosteroids

Correct answers

a. Uncontrolled asthma according to GINA guidelines with 400 μg of daily budesonide
c. In allergic asthma partially controlled with 1000 μg fluticasone-propionate daily
d. In difficult-to-treat asthma on systemic and inhaled corticosteroids

The safety of long-acting inhaled β-agonists (LABAs) has been a matter of debate for many years due to concern regarding a paradoxical increase in serious asthma exacerbations in some patients treated with these drugs. Shortly after approving salmeterol in 1994, the United States Federal Drug Administration (FDA) began to receive reports of serious asthma exacerbations and deaths in patients treated with the drug. To further evaluate these reports, the manufacturer conducted the Salmeterol Multicentre Asthma Research Trial (SMART). In this study there were eight more asthma-related deaths per 10 000 patients treated over the course of 28 weeks among patients treated with salmeterol than among those given placebo. Based on these studies, the FDA issued the following guidelines on the use of LABAs:

1. LABAs should not be used for asthma in patients of all ages without concomitant use of an asthma-controller medication, such as an inhaled corticosteroid.
2. Stop use of LABAs, if possible, once asthma control is achieved and maintain the use of an asthma-controller medication, such as an inhaled corticosteroid.
3. Recommend against LABA use in patients whose asthma is adequately controlled with a low- or medium-dose inhaled corticosteroid.
4. Recommend that a fixed-dose combination product containing a LABA and an inhaled corticosteroid be used to ensure compliance with concomitant therapy in paediatric and adolescent patients who require the addition of a LABA to an inhaled corticosteroid.

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HERMES Syllabus link: 6 Airway diseases
Angoff rating: 65%

Question 95

A 56-year-old female suffers from obstructive apnoea/hypopnoea syndrome. On polysomnography, her AHI was 42 events per h and her oxygen desaturation index (≥4%) was 40 events per h. Due to discomfort with this treatment, she refused the proposed CPAP therapy, although a sleep study confirmed that her AHI was reduced to 5 events per h by CPAP. Attempts to convince the patient to try nasal CPAP therapy again after adapting the mask and machine have been unsuccessful.
Which one of the following alternative treatments is the most promising to relieve the symptoms in this patient?

a. Mandibular advancement device
b. Uvulopalatopharyngoplasty
c. High-flow nasal insufflation
d. Modafinil
e. Nasal surgery

Correct answer

a. Mandibular advancement device

Although the magnitude of improvement in the AHI is generally greater with CPAP, mandibular advancement devices (MADs) are effective in the treatment of OSAS: 65% of patients achieve a 50% reduction in AHI. Snoring, subjective sleepiness, neuropsychological function and blood pressure have also been shown to decrease with MADs. Therefore, MADs are the alternative treatment of choice for patients with OSAS who are unwilling or unable to comply with CPAP therapy.

Uvulopalatopharyngoplasty (UPPP) performed by conventional techniques or with the use of a laser has provided inconsistent and unpredictable results. UPPP was widely adopted in the past as a single surgical treatment but, subsequently, a rate of failure of nearly 60% has been demonstrated among unselected patients.

High-flow insufflation of air into a nasal cannula has shown some benefit in reducing AHI. However, only scarce data about the effects on important outcomes, such as daytime sleepiness and blood pressure, are available.

Modafinil has been shown to be effective as an adjunct to CPAP in patients with residual sleepiness despite CPAP treatment. However, modafinil has no use in treatment of sleep apnoea *per se*. The main indication of the drug is the treatment of excessive sleepiness in narcolepsy patients.

Nasal obstruction promotes snoring and obstructive apnoea and interferes with successful nasal CPAP therapy. However, nasal surgery alone is not an effective treatment for OSAS.

References

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HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 59%

Question 96

Large randomised controlled trials in patients with mild to moderate COPD have shown unambiguously that inhaled bronchodilators improve which of the following?

a. FEV_1
b. Quality of life
c. Exacerbation rate
d. Mortality

Correct answers

a. FEV_1
b. Quality of life
c. Exacerbation rate

Large randomised controlled trials (RCTs) with β adrenergic agonists and tiotropium bromide have shown a significant improvement in FEV_1, quality of life (as evaluated by questionnaires) and the rate of exacerbations (defined either by a change in medication or a hospitalisation). Two large RCTs have failed to show a significant reduction in mortality in the intention-to-treat analysis. However, the significance level of $p=0.05$ was missed only by a small fraction. One large RCT in patients with chronic bronchitis and mild COPD showed a significant reduction of mortality in the intention-to-treat population with smoking cessation (intensive cessation programme using nicotine replacement therapy). When considering common treatment options it is useful to know on what grounds (*e.g.* study end-points) recommendations are made. It is also important to consider whether a treatment is instituted on symptomatic or prognostic grounds.

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HERMES Syllabus link: 6 Airway diseases
Angoff rating: 70%

Question 97

A 54-yr-old male smoker with a history of type II diabetes, hypothyroidism and obstructive sleep apnoea developed angina on exertion. A coronary angiogram showed that several cardiac vessels were critically occluded. Severe aortic stenosis was also diagnosed. Coronary artery bypass grafting and aortic valve replacement were performed. The patient had a good post-operative recovery and was assigned to cardiac rehabilitation and started on warfarin. Some weeks into the programme, he starts to complain of a cough, low-grade fever and worsening dyspnoea. A chest radiograph shows a moderate left-sided pleural effusion. A thoracentesis reveals the following: pH 7.35; glucose 3.5 $mmol \cdot L^{-1}$; lactate dehydrogenase (LDH) 590 $U \cdot L^{-1}$; and protein concentration 3.8 $g \cdot dL^{-1}$. Differential cell count revealed increased lymphocytes. Blood glucose is 5.6 $mmol \cdot L^{-1}$ and serum LDH is 410 $U \cdot L^{-1}$.
Which one of the following is the most likely diagnosis?

a. Heart failure
b. Hypothyroidism
c. Primary tuberculosis
d. Post-pericardiotomy syndrome
e. Intrapleural haemorrhage

Correct answer

d. Post-pericardiotomy syndrome

The post-pericardiotomy syndrome (PPCS; also known as post-cardiac injury syndrome or post-cardiotomy syndrome) refers to the occurrence of fever and pleuropericardial disease days or months after cardiac injury. Patients typically present within 1 week to 3 months. The condition is characterised by pericarditis with chest pain and a pericardial rub, fever, leukocytosis, and an elevated erythrocyte sedimentation rate. A pleural friction rub is a common feature. In PPCS the effusion is an exudate (elevated LDH and protein). In heart failure, the pleural effusion has a normal pH similar to that in the blood and the effusion is a transudate. Hypothyroidism may be associated with pleural effusions but not with low-grade fever and cough. There is no hint from the patient's history that an intrapleural haemorrhage was a likely cause of the effusion and blood would be easily detected during thoracentesis.

Table Light's criteria for exudates

Criterion	Sensitivity %	Specificity %
Total pleural protein concentration >3 g dL^{-1} or pleural fluid protein/serum protein ratio >0.5	89.5	90.9
Pleural LDH >200 U·L^{-1} or pleural fluid LDH/serum LDH ratio >0.6	91.4	85.0

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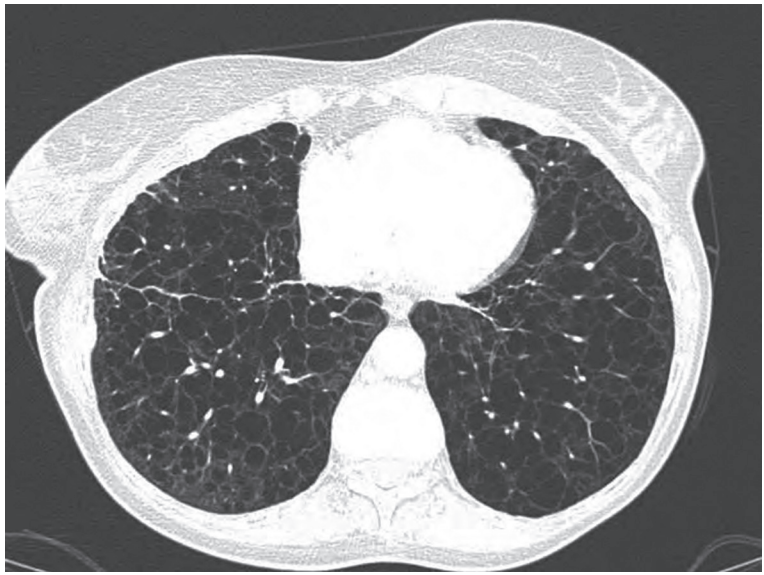
HERMES Syllabus link: 20 Pleural diseases
Angoff rating: 61%

Question 98

A 35-year-old female was admitted with acute dyspnoea, 12 months after the birth of her second child. During the past 6 months, she has suffered from mild dyspnoea (Medical Research Council grade 2) despite the fact that she has never smoked. Chest radiography revealed a unilateral pneumothorax, which was treated appropriately. The follow-up CT scan is shown below.



Which of the following is the most likely diagnosis?

a. Langerhans' cell histiocytosis
b. Alveolar proteinosis
c. Lymphangioleiomyomatosis
d. Amyloidosis
e. Sarcoidosis

Correct answer

c. Lymphangioleiomyomatosis

The described case has typical clinical and radiological features of lymphangioleiomyomatosis (LAM). LAM is almost exclusively seen in females of child-bearing age, as the pathogenesis is associated with oestrogen. Patients usually complain of dyspnoea on exertion. Pneumothoraces are common and relapsing. The chest CT typically shows diffuse, thin-walled cysts. There is no effective treatment but oestrogen replacement and pregnancy may be discouraged.

Although spontaneous pneumothorax is often the first manifestation of Langerhans' cell histiocytosis (LCH), LCH is typically associated with smoking. Radiologically, it initially presents with disseminated nodules, which eventually cavitate and develop into cysts or disappear. The cysts may enlarge and become confluent. In the cystic state, LCH eventually resembles emphysema, LAM or folliculin gene defect.

Alveolar proteinosis does not typically present with pneumothorax nor does it have a cystic appearance on CT scan. More typically, the CT scan shows 'crazy paving' with thickening of the septa and irregular ground-glass opacities. Bronchoalveolar lavage fluid looks milky.

Amyloidosis refers to the extracellular tissue deposition of fibrils composed of low molecular weight subunits of a variety of proteins. It is a complication of chronic inflammation or is due to monoclonal immunoglobulin light chain deposits. Clinically, there is multiorgan involvement and if there is any lung involvement, it can present with symptoms of airflow obstruction and/or haemoptysis. Radiographically, nodules and a diffuse alveolar–septal pattern may be present in parenchymal pulmonary amyloidosis.

Sarcoidosis is a granulomatous disease of unknown origin. If the lung is involved, the disease presents in four typical radiologically defined stages, as follows. Stage I: bihilar lymphadenopathy; stage II: bihilar lymphadenopathy and parenchymal infiltrates; stage III: only parenchymal infiltrates; and stage IV: parenchymal fibrosis. A cystic form of sarcoidosis would still have some aspects of fibrosis and parenchymal infiltration.

Reference

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HERMES Syllabus link: 25 Orphan and rare lung diseases
Angoff rating: 61%

Question 99

Which of the following statements about symptoms and signs of lung cancer is/are correct?

a. Horner syndrome indicates extrathoracic metastases.
b. Cushing syndrome includes hyperkalaemic acidosis and hyperglycaemia.
c. Lambert–Eaton myasthenic syndrome may be worse in the morning and improve during the day.
d. The severity of neurologic paraneoplastic syndromes is related to tumour bulk.

Correct answer

c. Lambert–Eaton myasthenic syndrome may be worse in the morning and improve during the day.

Horner syndrome refers to the triad of miosis, ipsilateral ptosis and lack of facial sweating. It is caused by infiltration of the sympathetic chain and stellate ganglion by lung cancer (*i.e.* intrathoracic, not extrathoracic, spread). Cushing syndrome may be the result of ectopic production of adrenocorticotropic hormone by small cell lung cancer. Clinical manifestations include weakness, muscle wasting, drowsiness, confusion, dependent oedema, moon facies, hypertension, hypokalaemic alkalosis, and hyperglycaemia. Lambert–Eaton myasthenic syndrome (LEMS) is characterised by gradual onset of proximal lower extremity weakness while proximal upper extremity weakness is usually less noticeable. Improvement of muscular strength with repeated testing is a distinctive symptom of LEMS and muscular weakness may improve during the day. The severity of the symptoms is not correlated with the tumour bulk. Even very small cancers may produce paraneoplastic syndromes. Typical paraneoplastic syndromes such as LEMS, stiff man syndrome or Cushing syndrome warrant a search for a tumour.

Reference

Spiro SG, *et al*. Initial evaluation of the patient with lung cancer: symptoms, signs, laboratory tests, and paraneoplastic syndromes. ACCP evidence-based clinical practice guidelines (2nd edition). *Chest* 2007; 132: 149S–160S.

HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 50%

Question 100

A 74-year-old previously healthy male presents to the emergency department with new onset of dyspnoea on mild exertion and a 10-day history of right calf swelling. He has fainted twice this morning, his blood pressure is 85/55 mmHg; his heart rate is 130 beats per min and regular. Arterial blood gases reveal a P_{aO_2} 7.4 kPa (56 mmHg), P_{aCO_2} of 3.7 kPa (28 mmHg) and pH of 7.47. Brain natriuretic polypeptide (BNP) and D-dimer are both elevated three-fold above the normal limit. A CT angiogram (angio-CT) confirms massive embolism of the common pulmonary artery reaching through the pulmonary valve.
Which of the following is the appropriate initial therapy for this patient?

a. 10-mg bolus of recombinant tissue-type plasminogen activator intravenously, then 90 mg over 2 h
b. 5000 IU heparin intravenously, followed by 25 000 IU over 24 h
c. 15 000 IU low molecular weight heparin subcutaneously once daily
d. Pulmonary artery catheter and selective intra-arterial thrombolysis
e. Surgical embolectomy of the pulmonary artery

Correct answer

a. 10-mg bolus of recombinant tissue-type plasminogen activator intravenously, then 90 mg over 2 h

The patient has suffered massive pulmonary embolism (PE) with a consecutive cardiogenic shock. Thrombolysis with recombinant tissue-type plasminogen activator in haemodynamically unstable patients (systolic blood pressure <90 mmHg) is likely to reduce mortality compared to heparin in patients with massive PE. Surgical embolectomy and selective intra-embolic thrombolysis through a pulmonary artery catheter are second-line options for massive PE in the proximal pulmonary arteries if systemic thrombolysis is contraindicated.

Reference

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HERMES Syllabus link: 14 Pulmonary vascular diseases
Angoff rating: 62%

Question 101

Which of the following statements concerning initiation of β-blocker treatment in patients with advanced COPD (Global Initiative for Chronic Obstructive Pulmonary Disease grade 3 or 4) on inhalation therapy with a long-acting β-agonist and inhaled corticosteroids is/are correct?

a. β-blockers are contraindicated.
b. Initiation of cardioselective β-blocker therapy should only be performed after measuring reversibility of airflow obstruction to inhaled β-agonists.
c. β-blockers increase the risk of exacerbations in patients with advanced COPD.
d. β-blockers reduce mortality in advanced COPD patients with overt cardiovascular diseases.

Correct answer

d. β-blockers reduce mortality in advanced COPD patients with overt cardiovascular diseases.

Historically, β-blockers have been avoided in asthma because of the risk of acute bronchospasm. These concerns have also been applied to COPD, with evidence of a reduction in FEV_1, increased airway hyperresponsiveness and inhibition of bronchodilator response to β-adrenergic agonists in patients receiving nonselective β-blockers and high doses of cardioselective β-blockers.
Despite the established benefits of β-blockers in treating hypertension, ischaemic heart disease and heart failure, many doctors are reluctant to prescribe β-blockers for patients with concurrent COPD. However, β-blockers are highly efficacious in the treatment of congestive heart failure and ischaemic coronary syndromes, and can reduce the total mortality of patients with these disorders by 30–40%. A nonrandomised trial by Rutten *et al.* (2010) showed that the use of β-blockers, contrary to classic teaching, is not only safe but can also prolong survival and reduce exacerbations in COPD. Other retrospective studies confirmed these results, demonstrating that β-blockers may reduce mortality, hospital admissions and COPD exacerbations when added to established inhaled therapy for COPD, independently of overt cardiovascular disease and cardiac drugs, and without adverse effects on pulmonary function.
In conclusion, β-blockers are not contraindicated in COPD.

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HERMES Syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases
Angoff rating: 61%

Question 102

A 34-year-old asthmatic female comes to the emergency room with progressive dyspnoea and non-productive cough over the past 3 days. Her best recorded peak expiratory flow is 60% of her personal best and she has a S_{pO_2} of 90%. She has stopped taking inhaled corticosteroids because she is 27 weeks pregnant and does not feel comfortable receiving medication while she is pregnant. She has been having mild symptoms for weeks. Now the symptoms have been getting worse and she has been waking at night for the past 10 days. She feels breathless and although she has used her relief inhaler every day in the past week and 3 times in the last hour, she does not feel better. Which one of the following is the most appropriate initial treatment for this patient?

a. High-dose inhaled corticosteroids and inhaled short-acting β-agonists.
b. Oxygen supplementation, high-dose inhaled corticosteroids and short-acting β-agonists.
c. Oral and inhaled corticosteroids and oxygen supplementation.
d. Systemic corticosteroids and short-acting β-agonists.
e. Oxygen supplementation, systemic corticosteroids and short-acting β-agonists.

Correct answer

e. Oxygen supplementation, systemic corticosteroids and short-acting β-agonists.

This patient shows uncontrolled asthma since she is having more than two of the following symptoms: daytime symptoms more than twice a week; limitation of activities; nocturnal symptoms; need for relief medication more than twice a week; lung function <80% of personal best. Inhaled steroids are not enough for this pregnant woman who has been uncontrolled for days. Acute asthma exacerbations should be managed in hospital with fetal monitoring and with use of steroids as needed. Maternal SaO_2 should be kept above 95%.

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Global Initiative for Asthma. The Global Strategy for Asthma Management and Prevention. www.ginasthma.org/local/uploads/files/GINA_Report_2015_May19.pdf Date last updated: May 19, 2015.

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HERMES Syllabus link: 6 Airway disease, 23 Pregnancy
Angoff rating: 57%

Question 103

A 45-year-old, HIV-positive male is admitted to the hospital because of fever and severe dyspnoea. Physical examination shows tachypnoea and tachycardia. Chest auscultation reveals bilateral fine crackles. Radiography shows extensive, bilateral, patchy lung infiltrates. Arterial blood gas analysis on room air reveals a P_{aO_2} of 6.0 kPa (45 mmHg), P_{aCO_2} of 1.5 kPa (11 mmHg) and pH of 7.56. He is intubated, and positive pressure ventilation is initiated with an inspiratory oxygen fraction (F_{IO_2}) of 0.5 and a positive end-expiratory pressure of 6 cmH_2O. Arterial blood gas analysis after half an hour demonstrates a P_{aO_2} of 6.7 kPa (50 mmHg), P_{aCO_2} of 3.0 kPa (22 mmHg) and pH of 7.52. Brain natriuretic peptide concentration is normal, and echocardigraphy shows normal systolic and diastolic function as well as normal respiratory variation of the inferior vena cava size.
Which of the following statements regarding this patient is/are correct?

a. A diagnosis of acute respiratory distress syndrome can be made.
b. The alveolar–arterial oxygen tension difference is corrected by oxygen administration.
c. The intrapulmonary shunt increases with increasing F_{IO_2}.
d. Prone position during positive pressure ventilation improves survival.

Correct answers

a. A diagnosis of acute respiratory distress syndrome can be made.
c. The intrapulmonary shunt increases with increasing F_{IO_2}.
d. Prone position during positive pressure ventilation improves survival.

The diagnosis of acute respiratory distress syndrome (ARDS) is based on chest radiography (*i.e.* bilateral infiltrates not fully explained by effusions, lobar/lung collapse or nodules), arterial blood gas findings (*i.e.* P_{aO_2}/F_{IO_2} ratio ≤40 kPa (≤300 mmHg)) and the presence of respiratory failure not fully explained by cardiac failure or fluid overload, verified by objective assessment (echocardiography and brain natriuretic peptide). In the present case, arterial hypoxaemia is only partially corrected by oxygen administration (P_{aO_2}/F_{IO_2} 13.4 kPa (100 mmHg)). It has been demonstrated that the degree of intrapulmonary shunting increases with increasing F_{IO_2}; the clinician should be aware of this when assessing the severity of respiratory failure by using the P_{aO_2}/F_{IO_2} ratio. A recent trial has shown that early application of prone-position ventilation in patients with severe ARDS decreases 28- and 90-day mortality.
The alveolar–arterial oxygen tension difference is not corrected by oxygen administration. In addition to increasing intrapulmonary shunting, oxygen administration does not correct underlying pathophysiological changes that occur due to capillary endothelial damage and alveolar epithelial damage, *i.e.* interstitial oedema due to increased protein influx in to the interstitial space and consecutive increase in oncotic pressure, and filling of the alveoli with oedema fluid and cellular debris. Additional loss of surfactant leads to alveolar collapse.

References

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HERMES Syllabus link: 5 Treatment modalities and prevention measures, 18 Respiratory failure
Angoff rating: 46%

Question 104

A 74-year-old female former smoker is referred to your office because of shortness of breath on moderate exertion. She has to stop after one flight of stairs because of dyspnoea but does not complain of chest pain. When asked, she also complains of frequent nocturnal awakenings and fatigue. She does not have fever, cough or sputum production. Her past medical history is remarkable for hypertension and a myocardial infarction 4 yrs ago. At that time, she had stopped smoking (after 45 pack-years exposure) and she has gained 8 kg of weight since. Her medication includes oral anticoagulation because of chronic atrial fibrillation, a diuretic, an angiotensin-converting enzyme (ACE) inhibitor and a tricyclic antidepressant. Her blood pressure is 125/75 mmHg, pulse rate is 65 beats per min and irregular, and lung auscultation is clear.

Pulmonary function tests show mild restriction and diffusion impairment. Arterial blood gas analysis shows a P_{aO_2} of 8.9 kPa (67 mmHg), P_{aCO_2} of 3.65 kPa (27 mmHg), pH of 7.44, base excess of 4 mmol·L^{-1} and S_{pO_2} of 94%.

Chest radiography shows no pulmonary infiltrates or mass, but there is apical redistribution of perfusion and cardiomegaly. Recently, the doses of the ACE inhibitor and of the diuretic have been adjusted, but this did not significantly improve her condition.

Which of the following evaluations will most likely contribute to improving her treatment?

a. Body plethysmography
b. Chest CT
c. Sleep study
d. Echocardiography
e. Spiroergometry

Correct answer

c. Sleep study

The dyspnoea of this patient might be due to chronic heart failure, since she has coronary artery disease, suffered from a myocardial infarction and has chronic atrial fibrillation. The daytime fatigue and poor sleep quality with frequent nocturnal awakenings are consistent with this differential diagnosis, since patients with heart failure may have nocturia and nocturnal Cheyne–Stokes respiration (CSR) leading to sleep disruption. Daytime fatigue and reduced exercise capacity are also typical symptoms of chronic heart failure. Factors associated with an increased risk of suffering from CSR in patients with heart failure include a higher New York Heart Association functional class, older age, severe heart failure (left ventricular ejection fraction of <45%), atrial fibrillation and a reduced exercise capacity. Typically, heart failure patients with CSR tend to chronically hyperventilate, which contributes to breathing instability because it drives P_{aCO_2} close to the apnoea threshold. The patient has several of the cited factors associated with CSR. Therefore, performing a sleep study is indicated and might reveal CSR, a condition that can be treated with nocturnal CPAP or adaptive servoventilation (if left ventricular ejection fraction is >45%) after optimisation of drug therapy if appropriate. Adaptive servoventilation has been shown to improve nocturnal CSR, sleep quality and daytime performance, but recent data suggest that it is associated with excess mortality in patients with severely impaired left ventricular systolic function (ejection fraction <45%).

The pulmonary function tests suggest mild restriction and impaired pulmonary diffusion, consistent with congestive heart failure. Performing body plethysmography might help to confirm reduced lung volumes but will not result in a change of treatment.

As a former smoker, the patient might suffer from emphysema or lung cancer that can be detected by chest CT even if the conventional chest radiograph shows a normal lung parenchyma. However, CSR is a more likely cause of her complaints and is more amenable to treatment.

Echocardiography might help to grade heart failure severity but is unlikely to alter therapeutic management. Measuring brain natriuretic peptide is useful to monitor patients with heart failure but also might not provide information leading to changes in treatment.

References

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Oldenburg O, *et al.* Sleep-disordered breathing in patients with symptomatic heart failure: a contemporary study of prevalence in and characteristics of 700 patients. *Eur J Heart Fail* 2007; 9: 251–257.

Pepperell JC, *et al.* A randomized controlled trial of adaptive ventilation for Cheyne-Stokes breathing in heart failure. *Am J Respir Crit Care Med* 2003; 168: 1109–1114.

Philippe C, *et al.* Compliance with and effectiveness of adaptive servoventilation versus continuous positive airway pressure in the treatment of Cheyne–Stokes respiration in heart failure over a six month period. *Heart* 2006; 92: 337–342.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 58%

Question 105

Which of the following statements about anti-tuberculosis (anti-TB) drugs is/are correct?

a. Anti-TB drugs have three major principles of action: bactericidal action, sterilisation and prevention of emergence of bacterial resistance.
b. Streptomycin is included in the standard recommended regimen for the treatment of TB as it has a lower resistance rate than ethambutol.
c. If pyrazinamide cannot be used, the standard recommended regimen for the treatment of TB has to be given for 12 months.
d. Initial cavitation and positive sputum culture after 2 months of correct treatment justify the prolongation of the continuation phase of anti-TB therapy to give a total duration of 9 months.

Correct answers

a. Anti-TB drugs have three major principles of action: bactericidal action, sterilisation and prevention of emergence of bacterial resistance.
d. Initial cavitation and positive sputum culture after 2 months of correct treatment justify the prolongation of the continuation phase of anti-TB therapy to give a total duration of 9 months.

Anti-TB drugs have the major actions listed above. The initial standard regimen includes the four drugs isoniazid (INH), rifampizin, pyrazinamide and ethambutol for 2 months followed by INH and rifampicin for an additional 4 months if mycobateriae are sensitive to these drugs. Streptomycin is not included in the standard regimen because it has more undesirable effects, such as renal toxicity and ototoxicity, has a higher resistance rate than ethambutol and is injectable and therefore difficult to administer. If the bactericidal drug pyrazinamide cannot be used, the treatment has to be given for 9 months instead of the standard 6 months. The Centers for Disease Control and Prevention states that cavitation and positive culture after 2 months of treatment justifies a prolongation of the continuation phase to 9 months, since the relapse rate in patients with these risk factors is 10 times as high as that in patients without cavitation or positive culture after 2 months (21% *versus* 2%).

References

World Health Organization. Treatment of Tuberculosis: Guidelines for National Programmes. 4th edition.WHO/HTM/TB/2009.420.http://whqlibdoc.who.int/publications/2010/9789241547833_eng.pdf

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HERMES Syllabus link : 8 Mycobacterial diseases
Angoff rating: 54%

Question 106

At which of the following points does the maximum flow–volume curve cross the volume axis?

a. Expiratory reserve volume and FVC
b. Functional residual capacity and FVC
c. Residual volume and TLC
d. Minimum and maximum expiratory flow
e. Maximal inspiratory and expiratory flow

Correct answer

c. Residual volume and TLC

Spirometry is expressed graphically as volume–time and flow–volume curves (figure). In the flow–volume curve, lung volumes are plotted along the horizontal axis and flow is plotted up the vertical axis, conventionally with expiratory flow as positive and inspiratory flow as negative values. The maximal flow–volume curve is obtained when after inhalation to maximal lung capacity (TLC), a forced exhalation follows until no more air can be exhaled (residual volume (RV)). Therefore, the correct answer is RV and TLC.

Functional residual capacity (FRC) is the lung volume at the end of passive exhalation during tidal breathing and can only be detected when tidal breathing is recorded (figure). Expiratory reserve volume is the volume between FRC and RV that, again, is not recorded when forced exhalation is maintained until RV is reached.

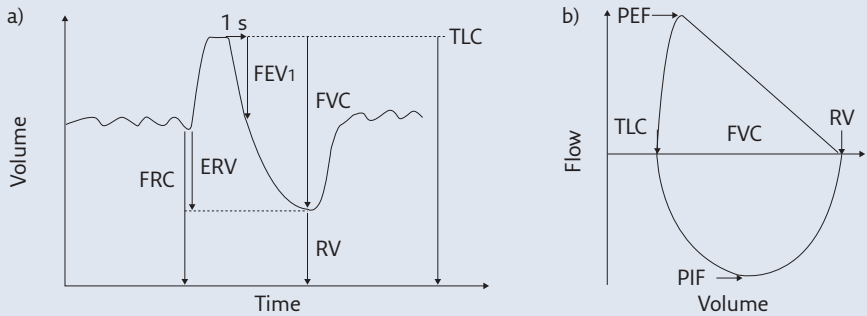

FIGURE. a) Volume–time curve recorded during spirometry. b) Flow–volume curve from forced expiration during spirometry. FRC: functional residual capacity; ERV: expiratory reserve volume; PEF: peak expiratory flow; PIF: peak inspiratory flow.

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Pellegrino R, *et al.* Interpretative strategies for lung function tests. *Eur Respir J* 2005; 26: 948–968.

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HERMES Syllabus link: 3 Pulmonary function testing
Angoff rating: 72%

Question 107

A 57-year-old male previously diagnosed with non-Hodgkin's lymphoma (NHL) presents with a cough and dyspnoea for 1 week. He has a history of night sweats. Examination shows a right-sided pleural effusion. A thoracentesis of the effusion reveals a milky fluid.
Which one of the following statements concerning the pleural fluid is most likely to be true?

a. It has a low concentration of immunoglobulins.
b. It has a low pH.
c. Its electrolyte content is lower than that of the serum.
d. Fasting makes it less milky in colour.
e. It has a high level of eosinophils.

Correct answer

d. Fasting makes it less milky in colour.

The vignette describes a chylous pleural effusion. Chylothoraces occur more commonly in NHL than in Hodgkin's lymphoma. In NHL, chylothoraces are responsible for about 19% of all pleural effusions. Chyle has a high content of triglycerides in the form of chylomicrons, which produce the milky, opalescent appearance of lymphatic fluid. This milky appearance may clear during a fast and rapidly returns after eating of a meal containing fat. The electrolyte content of chyle is similar to that of plasma, and the protein concentration is usually greater than 3 g per L. Chyle is also rich in immunoglobulins and contains the fat-soluble vitamins absorbed from the intestines. Chyle contains lymphocytes, not eosinophils, as the major cellular component. A low pH in a pleural effusion is due to metabolic activity in empyema and sometimes in a cancer-related effusion. Chylothorax is not acidic.

Reference

Loddenkemper R. Pleural effusion. *In*: Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 428–431.

HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 55%

Question 108

A 58-year-old Spanish male smoker with a history of COPD (post-bronchodilator FEV_1 57% predicted) presents to the emergency department with a cough of more than 24 h duration accompanied by increased purulent sputum production. The patient has no history of lower respiratory tract infections and has received no antibiotics in the past 12 months. Physical examination: temperature 38.6ºC, heart rate 112 beats per min, respiratory rate 34 breaths per min, and blood pressure 132/84 mmHg. Examination of the chest reveals crackles in the right lower lung field. The chest radiograph shows consolidation of the right lower lobe. Laboratory tests show a leukocyte count of 22000 cells per µL with 90% neutrophils; sputum Gram stain shows mixed flora and many squamous epithelial cells. The patient is hospitalised.
Which empiric antibiotic therapy should be started in this patient?

a. Erythromycin
b. Azithromycin plus ceftriaxone
c. Ceftazidime plus amikacin
d. Co-trimoxazole
e. Ciprofloxacin

Correct answer

b. Azithromycin plus ceftriaxone

The most common cause for the community-acquired pneumonia of this patient is *Streptococcus pneumoniae*. Due to the high antibiotic resistance for erythromycin and possibly co-trimoxazole in this case, these are not preferable options for empirical antibiotic treatment. Regimens including anti-pseudomonal β-lactams (such as ceftazidime) and aminoglycosides (such as amikacin) are indicated in cases with increased risk for *Pseudomonas* infections. However, this is not the case for the vignette case with moderate airflow obstruction and no history of antibiotic use in the past year. The preferred treatment option is a non-anti-pseudomonal β-lactam (such as ceftriaxone) plus a newer macrolide (such as azithromycin) or a respiratory fluoroquinolone (such as moxifloxacin or levofloxacin), but not ciprofloxacin.
In certain areas of Europe different resistance patterns are observed that require specific adaptation of empiric antibiotic therapy.

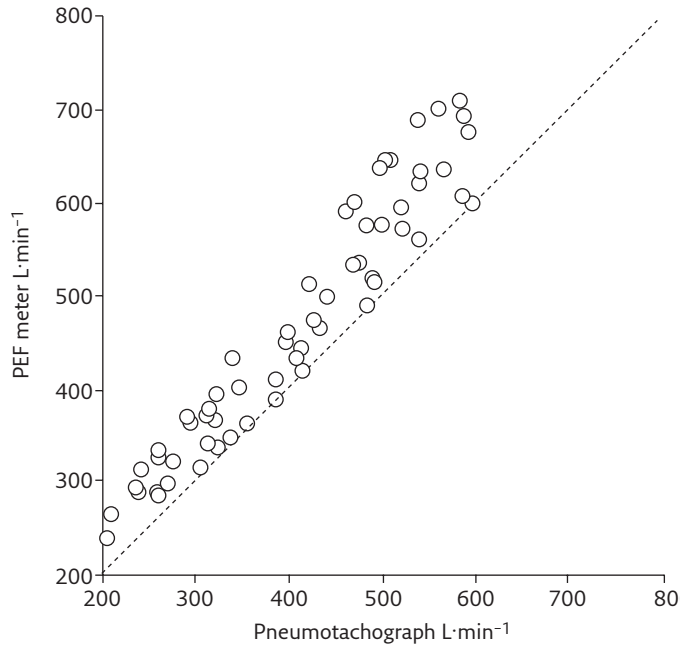
Reference

Woodhead M, *et al*. Guidelines for the management of adult lower respiratory tract infections – full version. *Clin Microbiol Infect* 2011; 17: Suppl. 6, E1–E59.

HERMES Syllabus link: 6 Airway diseases, 7 Respiratory infections
Angoff rating: 62%

Question 109

A sales representative demonstrates a new peak expiratory flow (PEF) meter to you. In his documentation, you find a graph (below) that shows comparisons between PEF measurements in 61 patients by the new PEF meter and corresponding values measured by a Fleisch pneumotachograph, which is considered the reference gold standard.



All data	n=61	r=0.96	r^2=0.92
PEF >500 L·min^{-1}	n=26	r=0.69	r^2=0.48
PEF ≤500 L·min^{-1}	n=35	r=0.94	r^2=0.89

A table accompanying the graph says that the coefficient of correlation (r) among all 61 paired measurements is 0.96. For PEF values ≤500 L·min^{-1}, the r=0.94, and for values >500 L·min^{-1}, r=0.69:
Which of the following statements is/are correct concerning this graph?

a. One of the correlation coefficients must be wrong as the correlation coefficient for the entire range of values cannot exceed any of the coefficients for a partial range.
b. The high correlation coefficient of 0.94 indicates that the new PEF meter and the pneumotachograph measure nearly identical values for the range PEF ≤500 L·min^{-1}.
c. There is <5% uncorrelated random variability in the values of the PEF meter (entire range).
d. The graphs and table are useless because no p-values are provided.

Correct answer

None of the statements is correct.

Introduction of new measurement techniques into clinical practice requires validation of the new technique by comparison to an established technique. The aim is to evaluate whether the technique in question provides results equivalent to those of the reference technique. Correlation analysis will show whether the results from two methods are linearly related but even a perfect correlation (r=1.0) does not mean that the methods agree: results from one method may have a systematic error and be a fraction or a multiple of those of the other method.

In order to test agreement between methods, Bland *et al.* (1986) proposed an approach that is widely used. It comprises graphical and numerical analyses including identity plots, *i.e.* results from one technique on one axis plotted against the corresponding results obtained by the other method on other axis, as shown in the graph. In addition, differences between the two methods are plotted against their mean value (figure). The mean of individual differences in paired measurements, called bias, provides a measure of agreement (horizontal line at −62 $L \cdot min^{-1}$ indicating a systematic underestimation of the PEF by the PEF meter. The range of two standard deviations from this mean is termed the limits of agreement (horizontal dashed lines in the figure at −140 and +12 $L \cdot min^{-1}$). 95% of the differences are expected to fall within this range. Whether limits of agreement are acceptable, *i.e.* indicating that the two methods are clinically exchangeable, requires clinical judgement.

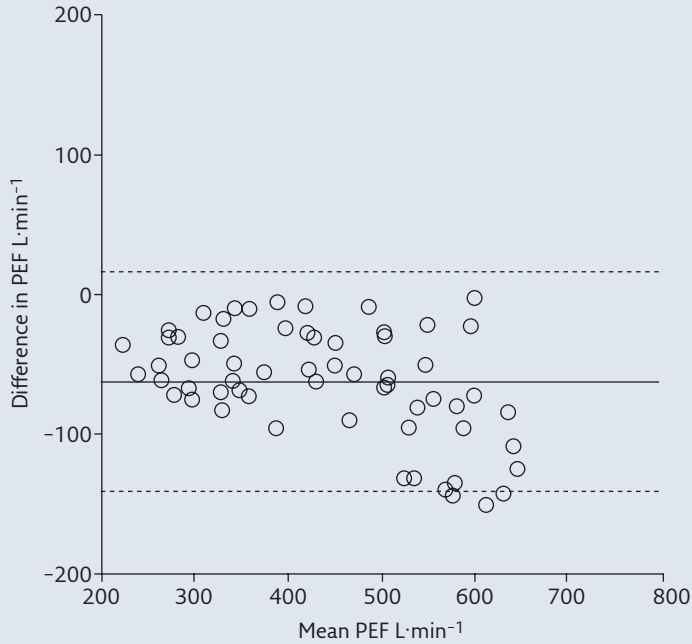


FIGURE. A graph of the difference in PEF between the PEF meter and the pneumotachograph *versus* the mean of the values obtained with the PEF meter and the pneumotachograph.

Reference

Bland MJ *et al*. Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet* 1986; 1: 307–310.

HERMES Syllabus link: 3 Pulmonary function testing
Angoff rating: 35%

Question 110

An obese 60-year-old man complains of dyspnoea on exertion that has slowly progressed over the past year. He has no haemoptysis, chest pain, orthopnoea or paroxysmal nocturnal dyspnoea. Cardiovascular examination reveals a pulse rate of 102 beats per min, a blood pressure of 130/80 mmHg and distant heart sounds. The lungs are clear. Chest radiography shows borderline cardiomegaly with normal lung fields. Right-sided catheterisation of the heart shows a pulmonary capillary wedge pressure of 20 mmHg, and systolic, diastolic and mean pulmonary artery pressures of 45, 27 and 33 mmHg, respectively.
Which is the most likely diagnosis?

a. Chronic thromboembolism
b. Schistosomiasis
c. Heart failure with preserved ejection fraction
d. Chronic sclerosing mediastinitis
e. Pulmonary hypertension from ingestion of tryptophan diet supplements

Correct answer

c. Heart failure with preserved ejection fraction

Pulmonary hypertension is defined as an increased mean pulmonary artery pressure (PAP) ≥25 mmHg at rest as assessed by right heart catheterisation. According to various combinations of values of pulmonary artery wedge pressure (PAWP), pulmonary vascular resistance and cardiac output, different haemodynamic definitions of pulmonary hypertension are shown in the table. Pre-capillary pulmonary hypertension includes clinical groups 1 and 3–5 while post-capillary pulmonary hypertension includes clinical group 2.

Table Classification of pulmonary hypertension (PH)

1 PAH
1.1 Idiopathic PAH
1.2 Heritable PAH
1.2.1 BMPR2
1.2.2 ALK-1, ENG, SMAD9, CAV1, KCNK3
1.2.3 Unknown
1.3 Drug and toxin induced
1.4 Associated with:
1.4.1 Connective tissue disease
1.4.2 HIV infection
1.4.3 Portal hypertension
1.4.4 Congenital heart diseases
1.4.5 Schistosomiasis
1′ Pulmonary veno-occlusive disease and/or pulmonary capillary haemangiomatosis
1″ PPHN
2 PH due to left heart disease
2.1 Left ventricular systolic dysfunction
2.2 Left ventricular diastolic dysfunction
2.3 Valvular disease
2.4 Congenital/acquired left heart inflow/outflow tract obstruction and congenital cardiomyopathies
3 PH due to lung diseases and/or hypoxia
3.1 COPD
3.2 Interstitial lung disease
3.3 Other pulmonary diseases with mixed restrictive and obstructive pattern
3.4 Sleep disordered breathing
3.5 Alveolar hypoventilation disorders
3.6 Chronic exposure to high altitude
3.7 Developmental lung diseases
4 CTEPH
5 PH with unclear multifactorial mechanisms
5.1 Haematological disorders: chronic haemolytic anaemia, myeloproliferative disorders, splenectomy
5.2 Systemic disorders: sarcoidosis, pulmonary histiocytosis, lymphangioleiomyomatosis
5.3 Metabolic disorders: glycogen storage disease, Gaucher disease, thyroid disorders
5.4 Others: tumoural obstruction, fibrosing mediastinitis, chronic renal failure, segmental PH

PAH: pulmonary arterial hypertension; BMPR2: bone morphogenetic protein receptor II; ALK: anaplastic lymphoma kinase; ENG: endoglin; CAV: caveolin; PPHN: persistent pulmonary hypertension of the newborn; CTEPH: chronic thromboembolic pulmonary hypertension. Reproduced and modified from Simonneau *et al.* (2013).

According to values of PAWP and PAP, the patient described in the vignette belongs to group 2 and the most likely diagnosis seems to be due to heart failure with preserved ejection fraction (diastolic dysfunction). In chronic thromboembolic pulmonary hypertension, pulmonary capillary wedge pressure is not elevated (<15 mmHg).

Eggs of *Schistosoma* can produce pulmonary hypertension. Patients infected by *Schistososma* generally present with a classical form of pulmonary hypertension, including a significant increase in pulmonary vascular resistance and, consequently, right heart failure. Pulmonary hypertension associated with schistosomiasis belongs to group 1. Schistosomiasis would also cause a pattern of pre-capillary pulmonary hypertension. In chronic thromboembolic pulmonary hypertension, the PAWP is usually <15 mmHg.

Chronic sclerosing mediastinitis does not cause elevated PAWP and there is no evidence of this disease on the chest radiograph.

Severe interstitial lung disease and pulmonary hypertension have been described in L-tryptophan-induced 'eosinophilia myalgia syndrome' but are associated with other systemic symptoms that may include, joint pain, weakness, fever, dyspnoea, cough, fatigue, oedema, rash, scleroderma-like skin changes, hair loss, neuropathy, eosinophilia and severe myalgia.

References

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HERMES Syllabus link: 14 Pulmonary vascular diseases
Angoff rating: 49%

Question 111

Which of the following options is of highest value for the diagnosis of hypersensitivity pneumonitis (extrinsic allergic alveolitis)?

a. Exposure to a known offending antigen
b. Eosinophils in bronchioalveolar lavage fluid
c. Serum precipitins
d. Delayed response to corticosteroids
e. Inspiratory squeaks on auscultation

Correct answer

a. Exposure to a known offending antigen

Identifying the offending antigens is key to a definite diagnosis of hypersensitivity pneumonitis. Therefore, thorough clinical history and evaluation of possible exposure to antigens known to induce hypersensitivity pneumonitis is essential. Furthermore, a removal of suspected sources or environments for 2–3 weeks and a re-exposure challenge could be performed to support the diagnosis of hypersensitivity pneumonitis.

Bronchioalveolar lavage (BAL) typically shows a marked lymphocytosis (>20% of recovered leukocytes) with a $CD4^+/CD8^+$ ratio of <1.0 (normal ratio: 2.3). BAL lymphocytosis accompanied by elevated levels of mast cells (>1%) can be seen in acute hypersensitivity pneumonitis. Additional elevated levels of elevated BAL neutrophils >5%, at times accompanied by eosinophils >5% of recovered leukocytes are sometimes seen in advanced disease.

Serum precipitins have a high rate of false negative results in acute and chronic hypersensitivity pneumonitis. In addition, intense and prolonged exposure to antigens, such as in farmers or bird fanciers may lead to positive serum precipitin reactions without a clinical correlate. Specific circulating antibodies are evidence of sensitisation but not of disease and should be seen as a marker of exposure. However, a positive test in the appropriate clinical setting and the selection of an appropriate panel of antigens most likely to be encountered in the patient's respective environment supports the diagnosis of hypersensitivity pneumonitis. Therefore, indiscriminate serum precipitin panels are not as helpful for the diagnosis of hypersensitivity pneumonitis.

It has been shown that systemic glucocorticoids accelerate initial recovery, particularly in severely ill patients and improve diffusion capacity of the lung for carbon monoxide after a month of treatment. Treatment is usually tapered over the course of 4–8 weeks.

While inspiratory crackles are one of the significant predictors of hypersensitivity pneumonitis, end-inspiratory squeaks are associated with bronchiolitis.

References

Sigsgaard T, *et al.* Hypersensitivity pneumonitis. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 337–340.

Selman M, *et al.* Hypersensitivity pneumonitis: insights in diagnosis and pathobiology. *Am J Respir Crit Care Med* 2012; 186: 314–324.

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HERMES examination blueprint: 12 Eosinophilic diseases, 13 Respiratory consequences of systemic/extrapulmonary disorders
Angoff rating: 53%

Question 112

A 75-year-old female is admitted to the emergency department after a car accident. Besides complaining of lower back pain and some bruising of the chest, the patient seems well. She has been treated for rheumatoid arthritis for many years with methotrexate. Vital signs and physical examination do not reveal any abnormalities. The chest radiograph is normal except for spine osteophytic degeneration.

Two days after being sent home with analgesic treatment, the patient returns to the emergency department. She now complains of dyspnoea. Physical examination reveals reduced breath sounds on the left lung base. The chest radiograph shows a moderate-sized left pleural effusion but no pulmonary infiltrates. Pleural fluid with a milky appearance is drained.

Which of the following pleural fluid analyses confirms the suspected diagnosis?

a. Cholesterol concentration
b. Triglycerides concentration
c. Gram and Ziehl–Neelsen staining
d. Rheumatoid factors
e. Methotrexate concentration

Correct answer

b. Triglycerides concentration

Based on the history and the milky appearance of the pleural fluid, a rupture of the ductus thoracicus is the most likely diagnosis. A haemothorax can be excluded by the non-bloody appearance of the effusion. The first chest radiograph did not show any effusion; therefore, chronic conditions such as tuberculosis or a rheumatoid pleuritis are unlikely. Methotrexate may cause interstitial pneumonitis but pleural effusion is not a typical side-effect of the drug and its measurement in pleural fluid would not contribute to confirming the diagnosis. Acute infection with empyema is also unlikely, as the patient did not have fever nor did the radiograph show pulmonary infiltrates; unlike chylothorax, the pleural fluid in empyema clears after centrifugation. Trauma and lung cancer cause pseudochylothoraces in rare cases. They develop after long-standing pleural effusion and it is assumed that cell lysis releases cholesterol, which is poorly absorbed through the pleural membrane. A traumatic thoracic duct lesion, as in the described case, accounts for ~50% of cases of chylothorax. Elevated triglyceride levels (>1.24 $mmol \cdot L^{-1}$) or presence of chylomicrons confirm the diagnosis of a chylothorax.

References

Apostolakis E, *et al.* Traumatic chylothorax following blunt thoracic trauma. *J Card Surg* 2009; 24: 220–222.

Skouras V, *et al.* Chylothorax: diagnostic approach. *Curr Opin Pulm Med* 2010; 16: 387–393.

Stradling J, *et al.* Oxford Case Histories in Respiratory Medicine. Oxford, Oxford University Press, 2010.

HERMES Syllabus link: 20 Pleural diseases
Angoff rating: 65%

Question 113

Which of the following statements about small cell carcinoma is true?

a. Approximately 80% of the patients with limited small cell carcinoma show good initial responses to treatment by showing clinical regression of symptoms and radiological regression of tumour size.
b. When it presents as a peripheral lesion, the 5-year survival rate is approximately 50%.
c. Whole-brain irradiation administered prophylactically has been shown to increase the survival rate and should be given to all patients.
d. Superior vena cava syndrome from tumour obstruction adversely affects regression of tumour size with therapy.
e. Hypercalcaemia from production of ectopic parathyroid hormone is the most common paraneoplastic syndrome.

Correct answer

a. Approximately 80% of the patients with limited small cell carcinoma show good initial responses to treatment by showing clinical regression of symptoms and radiological regression of tumour size.

Most patients with either limited or extensive disease initially respond to treatment. The median survival for limited disease is 18–24 months with a 5-year survival of 20–25%. For extensive disease, the median survival is 9–10 months, with <10% of patients alive at 2 years. Prophylactic cranial irradiation is not recommended in all patients but only in those who achieve a complete or partial response to initial therapy. It prolongs survival in these patients. Hypercalcaemia due to ectopic parathyroid hormone production is a paraneoplastic syndrome usually associated with squamous cell lung cancer.

References

Jett JR, *et al.* Treatment of SCLC. ACCP Guidelines for Diagnosis and Management of Lung Cancer, 3rd Ed. *Chest* 2013; 143: Suppl., e400S–e419S.

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Ost DE, *et al.* Clinical and organizational factors in the initial evaluation of patients with lung cancer. ACCP Guidelines for Diagnosis and Management of Lung Cancer, 3rd Ed. *Chest* 2013; 143: Suppl., e1215S–e1415S.

HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 55%

Question 114

A 63-year-old male is admitted to hospital because of dyspnoea, without fever. The patient reports mild dyspnoea on exertion during the last year. He is short of breath in the mornings, specifically when getting out of bed. Physical examination reveals the use of respiratory accessory muscles; breath sounds are slightly decreased and no jugular venous distension is present. On the abdomen, there are occasional spider naevi, and hepatomegaly and ascites are noted. Oxygen saturation is 86% in the sitting position and increases to 91% with the patient lying down. Laboratory blood tests, including white blood cell count, D-dimer, brain natriuretic protein, troponin and myoglobin, and ECG, are normal. Chest radiography shows cardiomegaly with bilateral pleural effusions. Ultrasound-guided paracentesis is performed and 1 L fluid is removed. Fluid examination reveals a polymorphonuclear cell count of 100×10^6 cells per L, a protein concentration of 3.9 $g \cdot dL^{-1}$, and no organisms on Gram stain and culture.
Which of the following is the most likely diagnosis?

a. Pneumonia
b. Hepatopulmonary syndrome
c. Pulmonary embolism
d. Spontaneous bacterial peritonitis
e. Chronic heart failure

Correct answer

b. Hepatopulmonary syndrome

Pneumonia can be excluded because of the absence of fever, blood leukocytosis and pulmonary infiltrates on the chest radiograph. Pulmonary embolism is ruled out by normal D-dimers. Chronic heart failure is unlikely because of the normal chest radiograph, absence of jugular venous distension and normal brain natriuretic protein. Since no organisms were identified on Gram stain and culture of ascitic fluid, and the polymorphonuclear cell count was $<250\times10^6$ cells per L, the diagnosis of spontaneous bacterial peritonitis can be excluded. The most likely diagnosis is hepatopulmonary syndrome (HPS). Characteristic signs of HPS are platypnoea (*i.e.* the increase in dyspnoea from the supine to upright position) and associated orthodeoxia (*i.e.* the decrease in P_{aO_2} (or S_{pO_2}) from the supine to the upright position).

References

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Rodriguez-Roisin R, *et al.* Hepatopulmonary syndrome. A liver-induced lung vascular disorder. *N Engl J Med* 2008; 358: 2378–2387.

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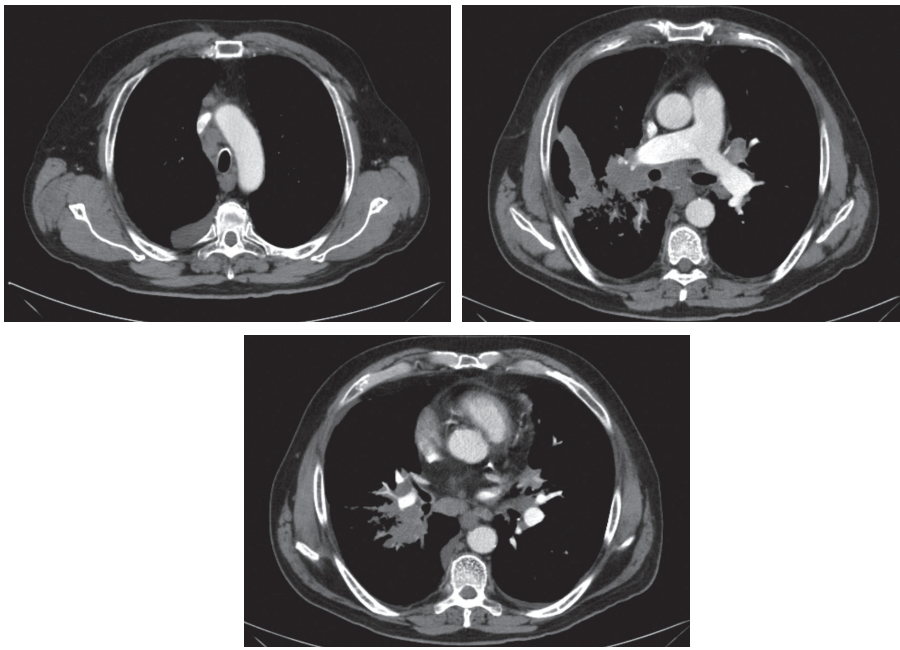
HERMES Syllabus link: 13 Respiratory consequences of systemic/extrapulmonary disorders
Angoff rating: 54%

Question 115

A 55-year-old male nurse is seen in your office. He has had blood-streaked haemoptysis for 2 weeks following an upper respiratory infection and bronchitis. He has lost 5 kg in the past month and has continued to work full-time. He had smoked for 35 years, but quit 2 weeks ago. The physical examination reveals a mildly obese man in no distress. The lymph node examination reveals a firm 1.5-cm right supraclavicular lymph node. The rest of the physical examination (including a careful neurological examination) is normal. The relevant slices of the chest CT are shown below. The liver and adrenal glands are normal. Bronchoscopy is performed and biopsy of a polypoid mass in the right lower lobe reveals squamous cell lung cancer. A fine-needle aspiration of the right supraclavicular lymph node is positive for squamous cell carcinoma.



What should be the treatment of this patient?

a. Combination chemotherapy and thoracic radiotherapy
b. Chemotherapy only
c. Thoracic radiotherapy only
d. Chemotherapy followed by surgery
e. Trimodal therapy

Correct answer

a. Combination chemotherapy and thoracic radiotherapy

This patient suffers from stage IIIB (T2, N3, M0) squamous cell carcinoma of the lung. The tumour is unresectable because of metastatic involvement of an ipsilateral supraclavicular lymph node (N3). Combined chemo–radiotherapy has been demonstrated to be more effective than either chemo- or radiotherapy alone for stage IIIB non-small cell lung cancer (NSCLC). Concurrent radio–chemotherapy has been shown to be superior over sequential chemo-radiotherapy in stage IIIB NSCLC. Median survival of stage IIIB NSCLC is 10 months.

Reference

Goldstraw P, *et al.* Non-small-cell lung cancer. *Lancet* 2011; 378: 1727–1740.

HERMES syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 63%

Question 116

A 75-year-old ex-smoker with COPD (Global Initiative for Chronic Obstructive Lung Disease grade 2) using long-acting bronchodilators has had shortness of breath, increased sputum expectoration and fever for 5 days. His heart rate is 115 beats per min, respiratory rate is 36 breaths per min, blood pressure is 100/65 mmHg and body temperature is 38.6ºC, and he seems slightly confused. On lung auscultation, you hear crackles, mainly in the right lung, and diffuse wheezes.
Which of the following is the best choice for the further management of this patient?

a. Hospitalisation, intravenous antibiotics and corticosteroids
b. Amoxicillin/clavulanic acid and a short-acting bronchodilator
c. Levofloxacin and corticosteroids
d. Ciprofloxacin and inhaled corticosteroids
e. Increased bronchodilator and clarithromycin

Correct answer

a. Hospitalisation, intravenous antibiotics and corticosteroids

This patient has suspected community-acquired pneumonia, defined by acute illness with cough meeting at least one of the following criteria: new focal chest signs; fever for >4 days or dyspnoea/tachypnoea; and no other obvious cause. A definitive diagnosis of pneumonia would be supported by a chest radiograph showing consolidation. Community-acquired pneumonia is a common and potentially very serious disease, especially in the elderly and in the presence of comorbidities. This 75-year-old patient with COPD has an increased respiratory rate (>30 breaths per min) and is slightly confused. Although his blood pressure is not <90 mmHg systolic or <60 mmHg diastolic, several factors associated with an increased risk of mortality are present and he should thus be hospitalised. The CRB-65 score (confusion, respiratory rate >30 breaths per min, blood pressure <90 mmHg systolic or <60 mmHg diastolic, and age >65 years) is 3. A score ≥1 (other than age >65 years alone) should prompt hospitalisation.

References

Bauer TT, *et al.* CRB-65 predicts death from community-acquired pneumonia. *J Intern Med* 2006; 260: 93–101.

Lim WS, *et al.* Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. *Thorax* 2003; 58: 377–382.

HERMES Syllabus link: 6 Airway diseases, 7 Respiratory infections
Angoff rating: 67%

Question 117

A 16-year-old boy presents with his parents for evaluation of severe daytime somnolence. The patient had been healthy until the beginning of the school year, when he started to have increasing difficulty getting out of bed for school in the morning. He frequently misses the bus due to his tardiness, and after arriving at school he has difficulty staying focused on class work and sometimes dozes off. He has failed his examinations. His parents do not feel that he snores excessively and they have never witnessed apnoeas or unusual motor activity during his sleep. The patient typically goes to bed by 22:30–23:00 h but he often watches television in bed, sometimes to as late as 04:00 h. His parents have discouraged him from staying up so late but he notes that if he turns off the lights at 22:30 h, he is unable to sleep for several hours. On weekends, he often sleeps until 14:00–15:00 h. Sleep hygiene measures have not worked.
Which one of the following is the most appropriate next step for this patient?

a. Human leukocyte antigen typing
b. Schedule a multiple sleep latency test
c. Prescribe methylphenidate 10 mg, to be administered every morning
d. Instruct the patient to record a sleep diary and advance his sleeping time
e. Request a screening nocturnal oximetry study

Correct answer

d. Instruct the patient to record a sleep diary and advance his sleeping time

The patient suffers from daytime hypersomnia, which can be caused by a large variety of underlying causes and can also appear idiopathically. A circadian rhythm disorder (delayed sleep phase syndrome) is the most likely diagnosis in this case. A shift of the sleep–wake distribution towards the day is typical in puberty. However, the degree described here is uncommon. Nevertheless, sleep habits, the amount of sleeping hours and the distribution of sleep throughout the 24-h period should be evaluated by a sleep diary as a first step in diagnostic evaluation. Actigraphy can be used to support sleep diary findings. Moreover, it may help to feed sleep characteristics back to the patient and to adapt these stepwise to social demands, such as school start.
The multiple sleep latency test and human leukocyte antigen testing are used in the diagnosis of narcolepsy, while nocturnal oximetry aids evaluation of sleep related breathing disorders. However, the history does not support either of these disorders. Melatonin to help advance sleep time, bright light therapy in the morning and methylphenidate may be indicated it in some cases of hypersomnia, but attempts to make a diagnosis should be made first.

References

American Academy of Sleep Medicine. International Classification of Sleep Disorders. 3rd Edn. Westchester, AASM, 2014.

Morgenthaler TI, *et al.* Practice parameters for the treatment of narcolepsy and other hypersomnias of central origin. *Sleep* 2007; 30: 1705–1711.

Bodkin CL, *et al.* Office evaluation of the "tired" or "sleepy" patient. *Semin Neurol* 2011; 31: 42–53.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 57%

Question 118

A 38-year-old black female is admitted to the hospital because of a 1-year history of dyspnoea on exertion, mild fever and muscle fatigue. She has never smoked. On admission, her blood pressure is 115/70 mmHg, pulse rate is 125 beats per min and rhythmic, and respiratory rate is 26 beats per min. Erythema nodosum is detected on the extensor aspects of the lower legs. Auscultation reveals bilateral fine crepitation in the posterior chest middle fields. In a chest radiograph, unilateral hilar adenopathy and bilateral pulmonary infiltrates are detected. Hypercalcaemia and hypercalciuria are the only abnormal laboratory tests.
Which of the following statements is most appropriate?

a. Spontaneous remission does not occur.
b. Guidelines suggest an initial dose of 5–10 mg prednisone per day.
c. 2 weeks are sufficient to evaluate the response to steroid treatment.
d. Hypercalcaemia and hypercalciuria are absolute indications for treatment.
e. Methotrexate may be used instead of steroids.

Correct answer

d. Hypercalcaemia and hypercalciuria are absolute indications for treatment

This case describes the typical clinical presentation of acute sarcoidosis, with hilar adenopathy, bilateral pulmonary infiltrates, hypercalcaemia, hypercalciuria and erythema nodosum. Sarcoidosis is a systemic granulomatous disease of undetermined aetiology. It is characterised by a variable clinical presentation and course. The lung is the most frequently organ involved. Spontaneous remissions occur in nearly two-thirds of patients. There are few absolute indications for treatment, including cardiac and neurological involvement, hypercalcaemia and hypercalciuria, and ocular disease, that do not respond to topical therapy. The main treatment consists in corticosteroid administration. Guidelines suggest an initial dose of oral prednisone at a dose of 20–40 mg per day and to evaluate the effect of treatment after 1–3 months. Methotrexate has been used widely as a steroid-sparing agent for sarcoidosis but has not been tested as a single therapy.

References

Costabel U. Sarcoidosis. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 382–385.

Iannuzzi MC, *et al.* Sarcoidosis. *N Engl J Med* 2007; 357: 2153–2165.

Baughman RP. Pulmonary sarcoidosis. *Clin Chest Med* 2004; 25: 521–530.

HERMES Syllabus link: 10 Interstitial lung disease, 13 Respiratory consequences of systemic/pulmonary disorders
Angoff rating: 65%

Question 119

In severe persistent allergic asthma, which of the following has therapy with the anti-IgE antibody omalizumab has been shown to do consistently?

a. Increase FEV_1
b. Improve the methacholine threshold
c. Decrease the frequency of exacerbations
d. Decrease the use of inhaled corticosteroids

Correct answers

c. Decrease the frequency of exacerbations
d. Decrease the use of inhaled corticosteroids

In a systematic review in 2011, Rodrigo *et al.* showed that omalizumab, compared to placebo, significantly decreased the number of exacerbations and the use of inhaled corticosteroids in this patient group. The FEV_1, however, did not change. In a study by Djukanović *et al.* (2004), no effect of omalizumab was seen on the methacholine threshold in patients with eosinophilic asthma.

References

Djukanović R, *et al.* Effects of treatment with anti-immunoglobulin E antibody omalizumab on airway inflammation in allergic asthma. *Am J Respir Crit Care Med* 2004; 170: 583–593.

Rodrigo GJ, *et al.* Omalizumab *vs* placebo as add-on therapy to corticosteroids for children and adults with asthma. A systematic review. *Chest* 2011; 139: 28–35.

HERMES Syllabus link: 6 Airway diseases
Angoff rating: 60%

Question 120

A 25-year-old African female presents to the emergency department. She has reportedly just completed a short-distance flight from Paris to London. She complains that she is short of breath, and has a cough and pain when taking deep breaths. She was in a good health until 1 week prior to her trip, when she developed a cold. On examination, she has pale conjunctivae. The chest examination shows a pleural rub but is otherwise normal. She has bilateral chronic leg ulcers.
Which of the following is the likely diagnosis?

a. Bornholm disease
b. Pneumothorax
c. Acute chest syndrome
d. Fat embolism
e. Pneumonia

Correct answer

c. Acute chest syndrome

Acute chest syndrome is one of the manifestations of sickle cell disease. The aetiology is not absolutely clear but it is thought to be caused by pulmonary vaso-occlusion either through fat emboli from the bone-marrow or through pulmonary microvascular thrombosis triggered by infection, especially community-acquired pneumonia. Tobacco smoke exposure is a possible risk factor. Acute chest syndrome often progresses to respiratory failure. The syndrome is the leading cause of death among sickle cell disease patients. Treatment is symptomatic with transfusions and bronchodilators.

The Wells score shows a low probability of a pulmonary embolism and a short-distance flight does not lead to long immobilisation; therefore, deep vein thrombosis is rather unlikely. Pale conjunctivae and leg ulcers are not associated with pneumothorax or pneumonia. Fat embolism, which is not associated with sickle cell crisis, is usually iatrogenic or trauma-related. There is no indication of any of these problems, and there is no connection between chronic leg ulcers and pale conjunctivae to non-sickle cell crisis associated fat embolism. Bornholm disease or epidemic pleurodynia is typically caused by coxsackievirus B. There is no indication in this case of epidemic chest pain, or any other coxsackievirus B-associated diseases like myopericarditis or meningitis.

References

Mellor A, *et al.* Fat metabolism. *Anasthesia* 2001; 56: 145–154.

Rees DC, *et al.* Sickle-cell disease. *Lancet* 2010; 376: 2018–2031.

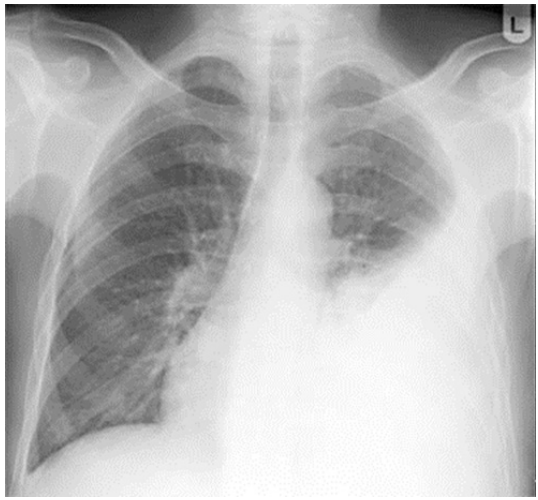
Vichinsky EP, *et al.* Causes and outcomes of the acute chest syndrome in sickle cell disease. National Acute Chest Syndrome Study Group. *N Engl J Med* 2000; 342: 1855–1865.

Wells PS, *et al.* Derivation of a simple clinical model to categorize patients probability of pulmonary embolism: increasing the models utility with the SimpliRED D-dimer. *Thromb Haemost* 2000; 83: 416–420.

HERMES Syllabus link: 13 Respiratory consequences of systemic/extrapulmonary disorders, 26 Genetic and developmental disorders
Angoff rating: 37%

Question 121

You see an otherwise healthy 52-year-old female who has been treated by her general practitioner for 10 days with oral amoxicillin for fever up to 39°C and cough. 7 days after finishing the antibiotic therapy, she still feels weak. Her temperature is 37.2°C (oral). On examination, her respiratory rate is 20 breaths per min; there is dullness to percussion and breath sounds in the left base are absent. The chest radiograph is shown below.
Which of the following statements is/are appropriate?



a. A diagnostic thoracentesis should be performed.
b. A course of diuretics will reduce dyspnoea.
c. A pleural fluid pH >7.4 suggests a simple parapneumonic effusion.
d. A pleural fluid pH <7.2 indicates the need for chest tube drainage.

Correct answers

a. A diagnostic thoracentesis should be performed.
c. A pleural fluid pH >7.4 suggests a simple parapneumonic effusion.
d. A pleural fluid pH <7.2 indicates the need for chest tube drainage.

A complicated parapneumonic effusion must be considered in the context of persistent fever in patients with pneumonia. Since the infection may persist in the pleural space, C-reactive protein or pro-calcitonin are poor measures of disease severity and requirement for further measures. Therefore, a diagnostic thoracentesis should be performed. A pleural fluid pH <7.2 indicates a complicated parapneumonic effusion. Spontaneous resolution is highly unlikely. Thus, intensified treatment is necessary. Although they are often negative, blood cultures and cultures from the pleural effusion should be taken. Therapy includes *i.v.* antibiotics and chest tube drainage guided by ultrasound. Small-bore (12–14 f) chest tubes are not inferior to large-bore tubes. If antibiotics and chest tube drainage do not lead to a clear improvement, thoracic surgery should be considered. A pH >7.4 indicates a simple parapneumonic effusion with a good prognosis. Chest tube drainage is not necessary in this case.

References

Clive A, *et al*. Pleural infection and lung abscess. *In:* Palange P, *et al*., eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 215–221.

Wrightson JM, *et al.* The approach to the patient with a parapneumonic effusion. *Semin Respir Crit Care Med* 2010; 31: 706–715.

HERMES Syllabus link: 7 Respiratory infections, 20 Pleural diseases
Angoff rating: 69%

Question 122

A 69-year-old teacher is consulting you as he has felt excessively sleepy during the day for several years. He reports almost having had an accident while driving on the motorway about 1 year ago due to lack of concentration. Recently, he hit a parked car because he had fallen asleep at the wheel. He complains of difficulty initiating night sleep and frequent awakenings, and he does not feel refreshed in the morning. His wife reports that he is a snorer and extremely restless during the night but she does not remember whether he has breathing pauses during the night. Another physician has performed nocturnal pulse oximetry, which showed 13 oxygen desaturations of >2% per h, 1% of the recording time with S_{pO_2} <90% and an irregular pulse rate.
Regarding the diagnosis, which of the following statements is most appropriate in this case?

a. Nocturnal polysomnography will provide important additional information.
b. Pulse oximetry is diagnostic for sleep disordered breathing.
c. Pulse oximetry rules out sleep apnoea syndrome.
d. A multiple sleep latency test might be diagnostic.
e. A 24-h ECG will reveal the cause of his symptoms.

Correct answer

a. Nocturnal polysomnography will provide important additional information.

Oximetry can be useful as a simple tool to diagnose OSA but cannot be relied on to rule out a diagnosis of OSA and is less reliable in mild cases or in patients with upper airway resistance syndrome. The sensitivity of nocturnal pulse oximetry in the diagnosis of OSA ranges from 31% to 98% and specificity ranges from 41% to 100%. Pulse oximetry may lead to misdiagnosis in patients with pulmonary disease such as COPD and associated nocturnal hypoventilation or heart failure. A multiple sleep latency test will confirm short sleep latency but not the cause of this. 24-h ECG may show sinus arrhythmia or other arrhythmia but will not reveal the diagnosis of sleep disorder. Polysomnography will add extra information on causes of poor sleep initiation, including periodic limb movements, and it will show arousals, and classify obstructive apnoeas and hypopnoeas, giving an accurate AHI.

References

McNicholas WT. Diagnosis of obstructive sleep apnea in adults. *Proc Am Thorac Soc* 2008; 5: 154–160.

Netzer N *et al*. Overnight pulse oximetry for sleep-disordered breathing in adults: a review. *Chest* 2001; 120: 625–633.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 67%

Question 123

Which one of following measures is least predictive of the risk of death in COPD patients?

a. BMI
b. Walking distance
c. Haematocrit
d. FEV_1
e. Dyspnoea score

Correct answer

c. Haematocrit

Studies in COPD patients have shown that age, FVC, FEV_1, inspiratory capacity, modified Medical Research Council (mMRC) dyspnoea score, 6-min walk distance, BMI, haematocrit and comorbidity measured by the Charlson index are all associated with the risk of death. The strongest associations were found with BMI (B), FEV_1 as measure of airflow obstruction (O), mMRC dyspnoea score (D) and exercise capacity measured by the 6-min walk distance. These variables were therefore incorporated into the BODE index (table). The BODE index is a simple tool to assess the probability of survival in COPD patients (figure).

Table Variables and point values used for the computation of the BODE index

Variable	Points on BODE index			
	0	**1**	**2**	**3**
FEV_1[#] % predicted	≥65	50–64	36–49	≤35
6-min walk distance m	≥350	250–349	150–249	≤149
mMRC dyspnoea score[¶]	0–1	2	3	4
BMI[+] $kg \cdot m^{-2}$	>21	≤21		

The cut-off values for the assignment of points are shown for each variable. The total possible values range from 0 to 10. [#]: based on stages identified by the American Thoracic Society; [¶]: scores can range from 0 to 4, with a score of 4 indicating that the patient is too breathless to leave the house or becomes breathless when dressing or undressing; [+]: values were 0 or 1 because of the inflection point in the inverse relationship between survival and BMI at a value of 21 $kg \cdot m^{-2}$. Reproduced from Celli *et al.* (2004).

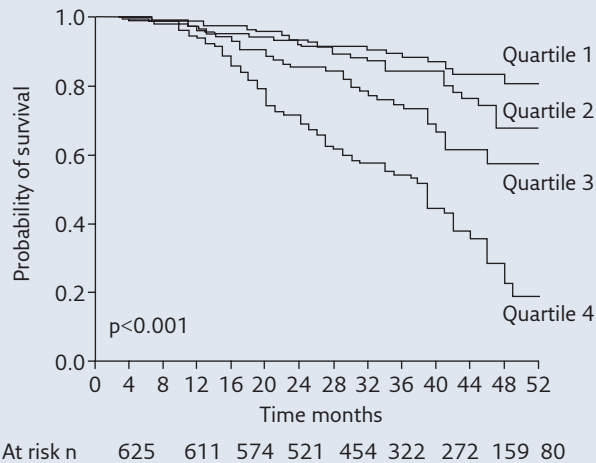


FIGURE. Kaplan–Meier survival curves for the four quartiles of the BODE index. Quartile 1 is a score of 0–2, quartile 2 is a score of 3–4, quartile 3 a score of 5–6 and quartile 4 a score of 7–10. p-value represents the log-rank test. Reproduced from Celli *et al.* (2004).

Reference

Celli BR, *et al.* The body-mass index, airflow obstruction, dyspnea, and exercise capacity index in chronic obstructive pulmonary disease. *N Engl J Med* 2004; 350: 1005–1012.

HERMES Syllabus link: 6 Airway diseases
Angoff rating: 63%

Question 124

A 35-year-old man is seen in the emergency department with a history of severe right-sided pleuritic pain of ~1 h duration. He had two mild episodes of similar pain in the last 36 h and has been short of breath for ~12 h. He sprained his ankle 8 h days previously. On physical examination, he is anxious, sweating and dyspnoeic. His temperature is 39ºC, pulse rate is 110 beats per min, respiratory rate is 28 breaths per min and blood pressure is 150/105 mmHg. Lung and heart examinations are normal except for an S4. A chest radiograph shows plate-like atelectasis at the right base with slight elevation of the right hemidiaphragm. Arterial blood gases are P_{aO_2} 9.3 kPa (70 mmHg), P_{aCO_2} 4.2 kPa (32 mmHg) and pH 7.47.
What should be done first?

a. Blood cultures
b. D-dimer testing
c. CT pulmonary angiography
d. Administration of low molecular weight heparin
e. Administration of factor XIa antagonist

Correct answer

d. Administer low molecular weight heparin

The patient's clinical history (recent orthopaedic surgery), clinical signs and symptoms (tachycardia and tachypnoea with pleuritic pain), and blood gas analysis showing hypoxaemia with hypocapnia, with the absence of radiographic signs that could be suspicious of a lung infection, seem more likely to be related to acute pulmonary embolism than to a lung infection. According to European Society of Cardiology pulmonary embolism guidelines, in patients with a high probability of pulmonary embolism, parenteral anticoagulation should be initiated while awaiting diagnostic tests. Low molecular weight heparin or fondaparinux are preferred over unfractionated heparin for initial anticoagulation, as they carry a lower risk of inducing major bleeding and heparin-induced thrombocytopenia. In this case with a high probability of pulmonary embolism, a CT pulmonary angiography must be performed as the next step after administration of low molecular weight heparin. D-dimer testing is not indicated, as it is used in low-probability settings (figure and table).

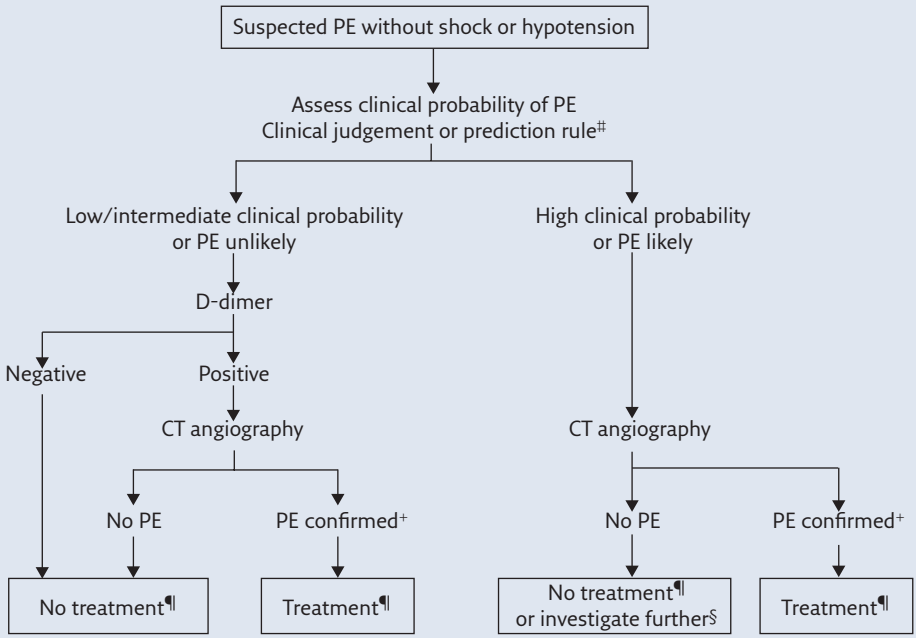


FIGURE. Proposed diagnostic algorithm for patients with suspected not high-risk pulmonary embolism (PE). #: two alternative classification schemes may be used for clinical probability measurement, *i.e.* a three- or two-level scheme (see table); when using a moderately sensitive assay, D-dimer measurement should be restricted to patients with low clinical probability or a PE-unlikely classification, while highly sensitive assays may also be used in patients with intermediate clinical probability of PE; note that plasma D-dimer measurement is of limited use in suspected PE occurring in hospitalised patients. ¶: anticoagulation treatment for PE. +: CT angiogram is considered to be diagnostic of PE if it shows PE at the segmental or more proximal level. §: in the case of a negative CT angiogram in patients with high clinical probability, further investigation may be considered before withholding PE-specific treatment. Reproduced and modified from Konstantinides *et al.* (2014) with permission from the publisher.

Table Clinical prediction rules for pulmonary embolism (PE)

Item	Clinical decision rule points	
	Original version	**Simplified version**
Wells rule		
Previous PE or DVT	1.5	1
Heart rate ≥100 beats per min	1.5	1
Surgery or immobilisation within the past 4 weeks	1.5	1
Haemoptysis	1	1
Active cancer	1	1
Clinical signs of DVT	3	1
Alternative diagnosis less likely than PE	3	1
Clinical probability		
Three-level score		
Low	0–1	NA
Intermediate	2–6	NA
High	≥7	NA
Two-level score		
PE unlikely	0–4	0–1
PE likely	≥5	≥2
Revised Geneva score		
Previous PE or DVT	3	1
Heart rate beats per min		
75–94	3	1
≥95	5	2
Surgery or fracture within the past month	2	1
Haemoptysis	2	1
Active cancer	2	1
Unilateral lower limb pain	3	1
Pain on lower limb deep venous palpitation and unilateral oedema	4	1
Age >65 years	1	1
Clinical probability		
Three-level score		
Low	0–3	0–1
Intermediate	4–10	2–4
High	≥11	≥5
Two-level score		
PE unlikely	0–5	0–2
PE likely	≥6	≥3

DVT: deep venous thrombosis; NA: not applicable. Reproduced and modified from Konstantinides *et al.* (2014) with permission from the publisher.

Reference

Konstantinides SV, *et al.* ESC Guidelines on the diagnosis and management of acute pulmonary embolism. *Eur Heart J* 2014; 35: 3033–3080.

HERMES Syllabus link: 14 Pulmonary vascular diseases
Angoff rating: 67%

Question 125

A 68-year-old male presents to his primary care physician with cough, sputum production and fever up to 39.5°C in the past 48 h. He has COPD (Global Initiative for Chronic Obstructive Lung Disease grade 4), and uses daily tiotropium and albuterol as needed. His diabetes mellitus is well controlled with metformin. He has a confirmed allergy to amoxicillin. On physical examination, he is tachypnoeic (30 breaths per min) and tachycardic (110 beats per min), with a blood pressure of 130/90 mmHg. He is alert and fully oriented. On auscultation, he has bilateral wheezing and crepitation on the right lung base. His laboratory tests reveal white blood count 14 000 cells per μL, C-reactive protein 30 $mg \cdot L^{-1}$, blood urea concentration 10 $mmol \cdot L^{-1}$ and S_{pO_2} 82%, on inhaled oxygen fraction 0.21. Chest radiography shows consolidation in the right upper and lower lung fields. Which of the following is the most appropriate antibiotic regimen for this patient?

a. Oral azithromycin
b. Oral ciprofloxacin
c. Intravenous ceftriaxone and azithromycin
d. Intravenous moxifloxacin and azithromycin
e. Intravenous aztreonam and moxifloxacin

Correct answer

e. Intravenous aztreonam and moxifloxacin

The patient has severe community-acquired pneumonia (CURB-65 score 3) (table) involving at least two lobes. Therefore, and because of his comorbidities (COPD and diabetes) and severe hypoxaemia, he needs to be treated in the hospital, ideally in a high-dependency or intensive care unit. The risk of pseudomonal infection should be assessed to guide empirical antibiotic therapy. *Pseudomonas aeruginosa* infection in COPD patients should be considered in the presence of at least two of the following: 1) recent hospitalisation; 2) frequent exacerbations (more than four courses of antibiotics per year); 3) severe COPD (FEV_1 <30% predicted); and 4) oral steroid use (>10 mg prednisolone daily in the past 2 weeks). Thus, there is no evidence of *P. aeruginosa* infection in this patient.

Table The CURB-65 and CRB-65 indices

	Sign/finding	CURB-65	CRB-65
C	Mental confusion	•	•
U	Blood urea concentration >7 $mmol \cdot L^{-1}$	•	
R	Respiratory rate ≥30 breaths per min	•	•
B	Systolic blood pressure <90 mmHg or diastolic blood pressure ≤60 mmHg	•	•
65	Age ≥65 years	•	•

The preferred regimen in this setting would be a non-antipseudomonal third-generation cephalosporin and a respiratory fluoroquinolone (moxifloxacin or levofloxacin) or a macrolide (a new macrolide such as azithromycin would be preferred over erythromycin). However, the patient is allergic to penicillin. Therefore, the usual cephalosporin has to be substituted with aztreonam, a monobactam, which has been shown to be safe to use in patients with penicillin allergy. Oral antibiotics are not an option in severely ill patients. Several scores have been developed to assess severity of pneumonia and associated mortality. Two well-validated and simple scores are the CURB-65 and its derivative that does not require a laboratory study, the CRB-65. Lim *et al.* (2003) compared the two scores. Using the CURB-65 index, pneumonia is considered mild (score 0–1, mortality 1.5%), moderate (score 2, mortality 9.2%) or severe (score 3–5, mortality 22%). Using the CRB-65 index, pneumonia is considered mild (score 0, mortality 1.5%), moderate (score 1–2, mortality 8.2%) or severe (score 3–4, mortality 31%). In patients with a CRB-65 ≥1 (except age ≥65 years alone), hospitalisation should be seriously considered.

References

Lim WS, *et al.* Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. *Thorax* 2003; 58: 377–382.

Mandel LA, *et al.* Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *Clin Infect Dis* 2007; 44: Suppl. 2, S27–S72.

Woodhead M, *et al.* Guidelines for the management of adult lower respiratory tract infections – summary. *Clin Microbiol Infect* 2011; 17: Suppl. 6, 1–24.

HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 40%

Question 126

Which of the following statements about hypersensitivity pneumonitis is not correct?

a. Alveolitis is due to an infiltration of the lung parenchyma by inflammatory cells.
b. Cellular content of the broncho-alveolar lavage (BAL) fluid of patients with hypersensitivity pneumonitis is higher than that observed in controls.
c. The inflammatory cells are mostly lymphocytes.
d. The majority of lymphocytes express B-cell markers.
e. The CD4/CD8 ratio is usually low.

Correct answer

d. The majority of lymphocytes express B-cell markers.

Hypersensitivity pneumonitis is an immunologically mediated inflammatory disease of the lung. It is caused by hypersensitivity to a variety of inhaled organic or inorganic antigens. Due to inflammation in the lung, interstitium and alveoli bronchoalveolar lavage shows high total cell and lymphocyte counts with accumulation of activated T-lymphocytes. Usually there is predominance of the CD8 T-lymphocytes subset resulting in a decrease in the CD4/CD8 ratio.

References

Costabel U. Extrinsic allergic alveolitis. *In:* Costabel U, ed. Atlas of Bronchoalveolar Lavage. 1st Edn. London, Chapman & Hall, 1998; pp. 25–28.

Sigsgaard T, *et al.* Hypersensitivity pneumonitis. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 337–340.

HERMES syllabus link: 13 Respiratory consequences of systemic/extrapulmonary disorders
Angoff rating: 54%

Question 127

A 58-year-old, female never-smoker presents with a mass on the left upper lobe with extensive mediastinal involvement. Bronchoscopy with biopsy reveals small cell lung cancer. Ipsilateral paratracheal and precarinal lymph nodes (N2) are cytologically positive but there are no distant metastases.
Which of the following is best treatment?

a. Radiotherapy
b. Platinum-based chemotherapy
c. Combination chemoradiotherapy
d. Complete resection followed by combined chemoradiotherapy
e. Concurrent chemotherapy and prophylactic cranial irradiation

Correct answer

c. Combination chemoradiotherapy

This is a case of limited-stage small cell lung cancer (SCLC) because the disease is confined to one hemithorax without extrathoracic metastases (with exception of the ipsilateral supraclavicular nodes) and can be treated in a single radiation field. In patients with limited-stage SCLC, combination chemoradiotherapy with accelerated hyperfractionated radiation therapy (twice-daily treatment) concurrent with platinum-based chemotherapy is recommended. Surgical resection is limited to patients with stage I SCLC after thorough evaluation for distal metastases and invasive mediastinal staging. Platinum-based chemotherapy alone is recommended in extensive-stage SCLC. Prophylactic cranial irradiation is recommended in patients with complete or partial response to the initial therapy but not concurrently with the initial chemotherapy.

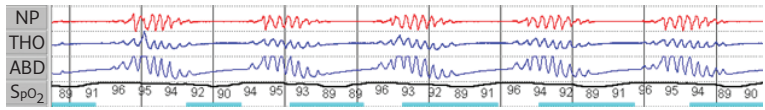
Reference

Jett JR *et al*. Treatment of small cell lung cancer: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2013; 143: Suppl., e400S–e419S.

HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 67%

Question 128

Which of the following statements concerning the nocturnal recording below is false?



Vertical lines represent 30-s intervals. NP: nasal pressure swings; THO: rib cage excursions; ABD: abdominal excursions.

a. This is a typical example of repetitive obstructive apnoeas.
b. This is a typical example of repetitive central apnoeas.
c. This breathing disturbance occurs at high altitude (5000 m above sea level).
d. Patients with severe heart failure are susceptible to this breathing disturbance.
e. Male sex, hypocapnia and atrial fibrillation promote this breathing disturbance.

Correct answer

a. This is a typical example of repetitive obstructive apnoeas.

This is a typical example of repetitive central apnoeas as evidenced by the absence of chest wall excursions during cessation of airflow. In patients with heart failure or stroke, the breathing pattern is termed Cheyne–Stokes respiration. A similar pattern of periodic breathing occurs in healthy subjects at high altitude. Patients with heart failure commonly show obstructive and, to a lesser degree, central sleep apnoea (CSA). The pathophysiology underlying CSA relates to an oscillation of the feedback loop controlling ventilation. According to theoretical reasoning, the following synergistically acting mechanisms favour an oscillation of ventilation.

- Hypocapnia is common in heart failure and partly explained by changes in pulmonary capillary wedge (*i.e.* left atrial) pressure, promoting increases in V'_E. This causes arterial carbon dioxide tension to move closer to the apnoea threshold and, thus, favours CSA.
- Low oxygen and carbon dioxide stores, due to the severity of heart failure and reduced lung volume in heart failure, favour CSA.
- A high ventilatory response, mainly to hypercapnia but also to hypoxia (*i.e.* a high controller gain), favours ventilatory instability.
- A low cardiac output, increased intracardiac dimensions and pulmonary congestion prolong the transit time between the lungs and chemoreceptors. Finally, sleep itself promotes CSA, as lung volumes are reduced in the prone position compared with upright posture.

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Bloch KE, *et al.* Central sleep apnoea. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 498–502.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 72%

Question 129

A 47-year-old woman comes to your office with 3 days of fever, shortness of breath and cough with mucoid sputum. On physical examination, she is alert but slightly confused; her temperature is 40ºC, respiratory rate is 34 breaths per min and blood pressure is 110/50 mmHg. Examination of the chest shows bibasal crackles; the chest radiograph shows bilateral lower lobe infiltrates. Arterial blood gases with the patient breathing room air are P_{aO_2} 6.1 kPa (46 mmHg) and P_{aCO_2} 3.7 kPa (28 mmHg). She is admitted to the hospital, and therapy with ceftriaxone and clarithromycin is started. *Legionella* pneumonia is suspected.
Which of the following is/are clinically useful tests for guiding the treatment of this patient?

a. Urinary antigen test for *Legionella*
b. Sputum culture for *Legionella* on selective medium
c. Acute serum titres for *Legionella* antibodies
d. DNA probe study of bronchoscopically obtained lower respiratory tract secretions

Correct answers

a. Urinary antigen test for *Legionella*
b. Sputum culture for *Legionella* on selective medium
d. DNA probe study of bronchoscopically obtained lower respiratory tract secretions

The urinary antigen test is currently the most helpful rapid test. This enzyme immunoassay is highly specific (>95%), and its sensitivity ranges between 65% and 80%, but it only detects the most frequent type of *Legionella* (*L. pneumophila* serogroup 1; ~90% of all Legionellaceae infections). Nevertheless, its use has been shown to reduce both mortality and the need for intensive care. The results are available within hours.

Culture from respiratory samples (usually sputum) is important and should be specifically ordered on suspicion of *Legionella* pneumonia together with the urinary antigen test. The cultures serve for confirmation and detection of non-*L. pneumophila* serogroup 1 *Legionella* infections. Culture results are usually available within 3–4 days.

While antibody serology used to be the mainstay test, it has become less important with the availability of urinary antigen testing, direct immunofluorescence staining and PCR. Because the definitive criterion for serological diagnosis requires a four-fold rise in antibody titre (IgG, or IgM and IgG) and/or the appearance of IgM titres, repeat serology is required up to 12 weeks after the onset of infection. A single elevated titre has been shown in up to 16% of healthy adults. Serology alone is, therefore, not very useful for clinical decision-making and treatment.

DNA amplification testing for *Legionella* by real-time PCR offers results within hours with a high specificity and sensitivity. This test is particularly useful in patients with suspected legionellosis but a negative urine antigen test. *Legionella* spp. other than *L. pneumophila* are fastidious and difficult to grow in culture but can be detected with PCR assays where available.

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HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 51%

Question 130

A 53-year-old male is diagnosed with small cell lung cancer (limited disease). His performance status is excellent (ECOG 0) and he is offered treatment with a combination of cisplatin and etoposide for 4–6 cycles. He comes to you for a second opinion.
Which of the following should you offer this patient?

a. Chemoradiotherapy
b. Immediate treatment with topotecan
c. Thoracic radiotherapy
d. Treatment with pemetrexed
e. Chemotherapy as proposed (cisplatin and etoposide)

Correct answer

a. Chemoradiotherapy

Studies have shown that multimodality treatment is better and therefore chemoradiotherapy is the treatment of choice for SCLC patients with limited disease and good performance status. Small cell lung cancer is a systemic disease and radiotherapy alone is not recommended. Topotecan should be considered as second-line treatment if the patient relapses but it is not a first-line treatment. Pemetrexed is used in nonsmall cell lung cancer and in particular adenocarcinoma in first, second or maintenance treatment regimens but it is not used in small cell lung cancer. Chemotherapy with cisplatin and etoposide is the recommended chemotherapy but it is better combined with radiotherapy.

References

Jett JR, *et al.* Treatment of small cell lung cancer: diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2013; 143: Suppl., e400S–e419S.

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HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 60%

Question 131

A 55-year-old chronic alcoholic man, who stopped drinking 2 weeks ago, complains of anorexia, bone pain, weakness, malaise and epigastric pain for 5 days. While antacids relieve the pain, the other symptoms persist. When the patient becomes confused, his family brings him to the emergency department. Physical examination reveals generalised muscle weakness and hyporeflexia. Because an arterial blood gas specimen shows values consistent with acute hypercapnic respiratory failure, the patient is intubated and mechanically ventilated.
In addition to standard care, which of the following treatments is likely to be most beneficial in correcting his ventilatory failure?

a. Plasmapheresis
b. Corticosteroids
c. Activated charcoal
d. Folic acid supplementation
e. Phosphate supplementation

Correct answer

e. Phosphate supplementation

Hypophosphataemia is frequently observed in alcoholic patients due to various pathophysiological mechanisms, such as inappropriate phosphaturia, increased phosphorus entry into cells and increased gastrointestinal loss of phosphate. Excessive antacid use could worsen a pre-existing hypophosphataemia. Mild hypophosphataemia (*i.e.* 2–2.5 $mg \cdot dL^{-1}$ (0.6–0.8 $mmol \cdot L^{-1}$)), whether acute or chronic, is generally asymptomatic. Patients with severe and/or chronic hypophosphataemia are more likely to be symptomatic. Muscle weakness, bone pain, rhabdomyolysis, skeletal disorders and altered mental status are the most common presenting features in chronic severe hypophosphataemia. Hypophosphataemia has also been shown to cause acute respiratory failure. The mechanism is believed to be due to decreased high-energy substrate availability at the cellular level leading to respiratory muscle dysfunction. Activated charcoal could be utilised in gastrointestinal decontamination in overdose patients. Folic acid, pyridoxine and thiamine should be administered to patients undergoing alcohol withdrawal. Corticosteroids have become a first-line therapy for biopsy-proven, severe alcoholic steatohepatitis.

References

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Kim W, *et al.* Severe alcoholic hepatitis-current concepts, diagnosis and treatment options. *World J Hepatol* 2014; 6: 688–695.

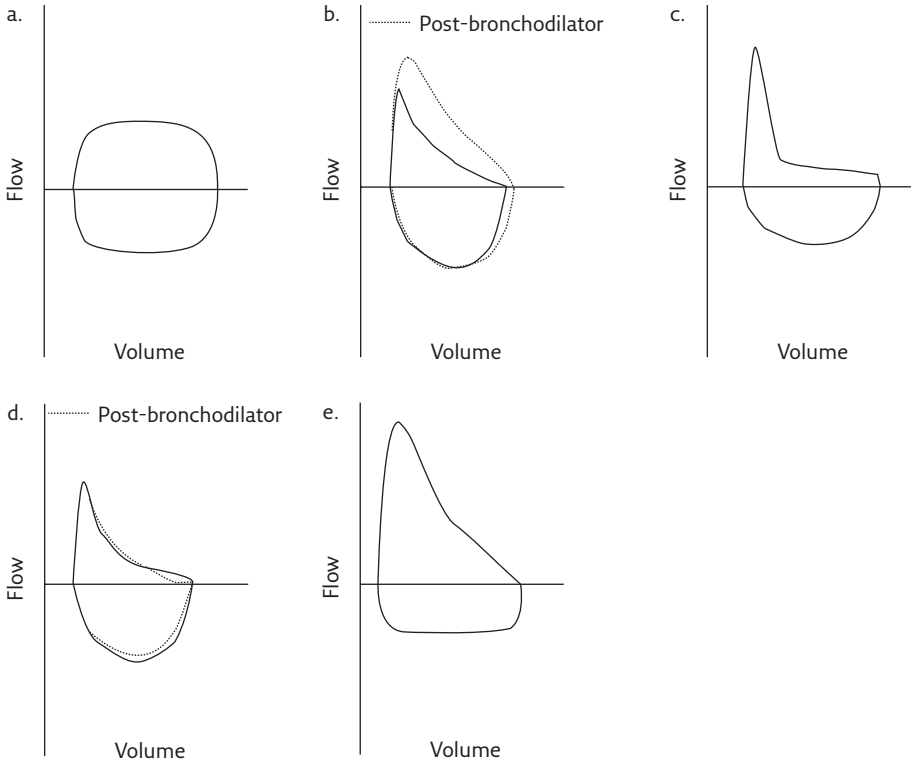
Lewis JF, *et al.* Hypophosphatemia and respiratory failure: prolonged abnormal energy metabolism demonstrated by nuclear magnetic resonance spectroscopy. *Am J Med* 1987; 83: 1139–1143.

Newman JH, *et al.* Acute respiratory failure associated with hypophosphatemia. *N Engl J Med* 1977; 296: 1101–1103.

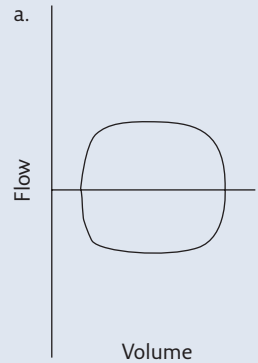
HERMES Syllabus link: 13 Respiratory consequences of systemic/extrapulmonary disorders, 18 Respiratory failure, 27 Associated specialties
Angoff rating: 39%

Question 132

A 34-year-old woman has dyspnoea on minimal exertion and inspiratory/expiratory stridor. 3 years ago, she was hospitalised for severe pneumonia, and was tracheotomised and mechanically ventilated for 6 weeks. You perform spirometry to confirm your suspected diagnosis.
Which of the following flow–volume curves is most likely to be recorded?



Correct answer



The history of this patient is suggestive of post-tracheotomy tracheal stenosis. This is a rare complication of tracheotomy (1–2% of tracheotomised or intubated patients have symptomatic tracheal stenosis). It is caused by excess granulation tissue at the site of the former endotracheal stoma and/or from a fractured cartilage ring. Post-intubation tracheal stenosis refers to a web-like stenosis at the site of an endotracheal tube cuff. It is thought to be caused by local necrosis following impaired mucosal blood flow due to pressure from the cuff. Large-volume, low-pressure cuffs have reduced this complication.

Our patient suffers from both inspiratory and expiratory stridor; therefore, flow limitation during inspiration and expiration is expected, as in curve a, which shows a box-like flow–volume loop. Curve e is consistent with a variable extrathoracic airway stenosis with inspiratory flow limitation. Curve c shows a sharp decrease in expiratory flow suggestive of tracheobronchial collapse, as in patients with emphysema or in cases of tracheobronchial malacia. Curve b shows reversible airflow obstruction, as observed in patients with asthma. Curve d shows mild impairment of expiratory flow without reversibility after inhalation of β-mimetics. Similar flow–volume loops are observed in patients with COPD.

References

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Zias N, *et al.* Post tracheostomy and post intubation tracheal stenosis: report of 31 cases and review of the literature. *BMC Pulm Med* 2008; 8: 18.

HERMES Syllabus link: 3 Pulmonary function testing
Angoff rating: 74%

Question 133

A 65-year-old man was hospitalised for an exacerbation of newly diagnosed COPD. He was discharged 4 weeks ago and now presents to your office for a regular check up in late spring. You perform a spirometry test with the following results: FVC, 2.52 L (77% predicted); FEV_1, 1.53 L (54% predicted); and FEV_1/FVC, 61%. He has now recovered and feels well. He has never received any vaccinations since childhood.
Which preventive approach against pneumonia is appropriate at this time?

a. Pneumococcal vaccine
b. *Pseudomonas* vaccine
c. *Haemophilus influenzae* type b vaccine
d. Influenza vaccine
e. None of the above

Correct answer

a. Pneumococcal vaccine

Pneumococcal polysaccharide vaccine is recommended for COPD patients aged ≥65 years as well as in younger patients with significant comorbid conditions, such as cardiac disease. In addition, this vaccine has been shown to reduce the incidence of community-acquired pneumonia in COPD patients aged <65 years with an FEV_1 <40% predicted. Pneumococcal conjugate vaccine protects against pneumonia even in patients aged >65 years.

Despite the recognition of *Pseudomonas aeruginosa* as an opportunistic pathogen in severe COPD patients, to date, no vaccine against this bacterium has obtained market authorisation.

Persons considered at increased risk for invasive *Haemophilus influenzae* type b disease include those with functional or anatomic asplenia, HIV infection, immunoglobulin deficiency (including immunoglobulin G2 subclass deficiency), or early component complement deficiency, recipients of a haematopoietic stem cell transplant, and those receiving chemotherapy or radiation therapy for malignant neoplasms. *H. influenzae* type b vaccination is not indicated for COPD patients.

Influenza vaccination can reduce serious illness (such as lower respiratory tract infections requiring hospitalisation) and death in COPD patients. Vaccines containing killed or live, inactivated viruses are recommended as they are more effective in elderly patients with COPD. The strains are adjusted each year for appropriate effectiveness and should be given once each year. The Centers for Disease Control and Prevention recommends that influenza vaccinations begin soon after the vaccine becomes available, ideally by October. However, as long as influenza viruses are circulating, it is not too late to vaccinate COPD patients, even in January or later. While seasonal influenza outbreaks can happen as early as October, most of the time influenza activity peaks between December and February. Since it takes about two weeks after vaccination for antibodies to develop, it is best that people are vaccinated in time to be protected before influenza viruses begin spreading in their community; so, influenza vaccination in the late spring is not recommended.

References

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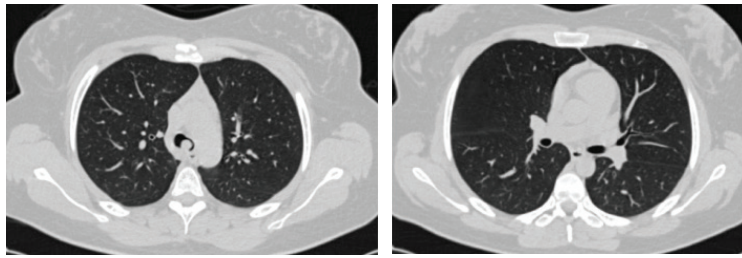
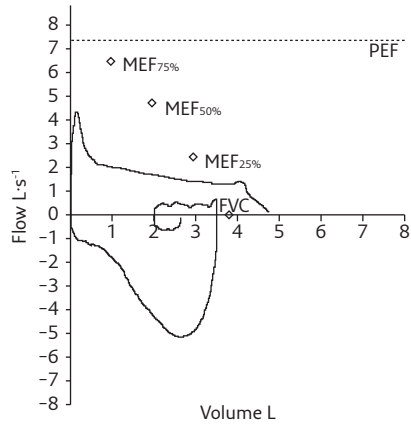
HERMES Syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases, 7 Respiratory infections
Angoff rating: 57%

Question 134

A 19-year-old female is referred to you for difficult-to-treat asthma. She has had a cough and breathlessness with noisy breathing for 1 year, and was diagnosed with asthma 8 months ago. Since then, she had been treated with salmeterol/fluticasone 50/500 µg twice daily and salbutamol as needed. Her chest radiograph is normal. Representative slices of her CT scan and her flow–volume curve are shown below.





MEF*x*%: predicted maximum expiratory flow at *x*% of FVC; PEF: predicted peak expiratory flow.

Which of the following additional investigations is most appropriate?

a. Anti-neutrophil cytoplasmic antibody assay
b. *T*LCO measurement
c. Bronchoscopy
d. Home peak flow monitoring
e. Assay of specific IgE and IgG against *Aspergillus fumigatus*

Correct answer

c. Bronchoscopy

Clinicians should always maintain a degree of scepticism regarding the diagnosis of severe difficult-to-treat asthma and establish whether the patient's history and evaluation truly represent asthma. Misdiagnosis of nonasthmatic conditions as uncontrolled asthma has been reported to be as high as 12–30%. The evaluation should start with a careful history with emphasis on asthma symptoms including dyspnoea (including exercised-related dyspnoea), cough, wheeze, chest tightness and nocturnal awakening. In addition, information should be obtained on exacerbating triggers and environmental or occupational factors that may contribute to the symptoms. Children and adults should be evaluated for other conditions that may mimic or be associated with asthma (table).

Table Diseases that can masquerade as severe asthma

Children
Dysfunctional breathing/vocal cord dysfunction
Bronchiolitis
Recurrent (micro)aspiration, reflux, swallowing dysfunction
Prematurity and related lung disease
Cystic fibrosis
Congenital or acquired immune deficiency
Primary ciliary dyskinesia
Central airways obstruction/compression
Foreign body
Congenital malformations including vascular ring
Tracheobronchomalacia
Carcinoid or other tumour
Mediastinal mass/enlarged lymph node
Congenital heart disease
Interstitial lung disease
Connective tissue disease
Adults
Dysfunctional breathlessness/vocal cord dysfunction
COPD
Hyperventilation with panic attacks
Bronchiolitis obliterans
Congestive heart failure
Adverse drug reaction (*e.g.* angiotensin-converting enzyme inhibitors)
Bronchiectasis/cystic fibrosis
Hypersensitivity pneumonitis
Hypereosinophilic syndromes
Pulmonary embolus
Herpetic tracheobronchitis
Endobronchial lesion/foreign body (*e.g.* amyloid, carcinoid, tracheal stricture)
Allergic bronchopulmonary aspergillosis
Acquired tracheobronchomalacia
Eosinophilic granulomatosis with polyangiitis

Reproduced and modified from Chung *et al*. (2014).

In the case presented here, the CT images shows a soft tissue lesion in the tracheal lumen, which could be the cause of patient's symptoms. Based on the clinical and radiological suspicion of tracheal tumour, the patient must be submitted to bronchoscopy. In the appropriate clinical setting, other tests can be helpful in the diagnosis of other conditions or diseases that can mimic or coexist with severe asthma: anti-neutrophil cytoplasmic antibody (ANCA) assay in the diagnosis of ANCA-positive vasculitis (eosinophilic granulomatosis with polyangiitis); assay of specific IgE and IgG against *A. fumigatus* in the diagnosis of allergic bronchopulmonary aspergillosis; and T_{LCO} measurement in the differentiation between asthma and COPD or the coexistence of these two diseases (asthma–COPD overlap syndrome) in smoking patients. Finally, home peak flow monitoring can be helpful to confirm or exclude the asthma diagnosis (lack of variability in vocal cord dysfunction and hyperventilation with panic attacks) and to identify possible triggering factors. The flow–volume curve shows expiratory flow limitation consistent with intrathoracic central airway obstruction.

References

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HERMES Syllabus link: 6 Airway diseases
Angoff rating: 65%

Question 135

A 64-year-old female presents to the emergency department complaining of sudden onset of dyspnoea with pleuritic chest pain in her left hemithorax for the past 3 h. The patient underwent coronary artery bypass graft surgery 9 months ago and has been in a stable condition ever since. Her treatment includes a β-blocker, an angiotensin-converting enzyme inhibitor, furosemide and low-dose aspirin. On examination she is dyspnoeic with a respiratory rate of 18 breaths per min; heart rate is 112 beats per min. Auscultation reveals decreased breath sounds at the base of the left lung. Her ankles are symmetrically swollen and non-tender. S_{pO_2} on room air is 88%. The ECG reveals a sinus tachycardia of 104 beats per min but no other abnormal findings. Chest radiography confirms a small pleural effusion on the left side.
Which of the following options is the most appropriate next step in the management of this patient?

a. Thoracentesis
b. Administration of intravenous diuretics and observation
c. Lower-limb ultrasonography
d. Measurement of D-dimer with ELISA
e. Chest CT with contrast

Correct answer

d. Measurement of D-dimer with ELISA

The history of coronary artery disease, the symmetrical ankle oedema and the small pleural effusion may be suggestive of heart failure. However, heart failure would not explain pleuritic chest pain and a unilateral left-sided pleural effusion is rare in heart failure. The fact that the patient presents with sudden onset of pleuritic chest pain, dyspnoea and tachypnoea, along with the small pleural effusion, raises the possibility of pulmonary embolism.
Based on the Wells criteria (table), this patient has a moderate pre-test probability for pulmonary embolism (pulmonary embolism is more likely than alternative diagnosis; heart rate is >100 beats per min, total score 4.5 points). Therefore, the next appropriate step in the management would be to perform a D-dimer test. A negative D-dimer test with ELISA would rule out pulmonary embolism. If the D-dimer test is positive, a spiral-CT angiogram should be performed to confirm or rule out pulmonary embolism since the D-dimer test is sensitive but nonspecific.

Table 2 The Wells criteria for predicting pulmonary embolism, pre-test

Variable	Score
Deep vein thrombosis symptoms/signs	3.0
Pulmonary embolism at least as likely as another diagnosis	3.0
Heart rate >100 beats per min	1.5
Immobilisation or surgery in past 4 weeks	1.5
Previous deep vein thrombosis or pulmonary embolism	1.5
Haemoptysis	1.0
Cancer	1.0
Pre-test probability of pulmonary embolism	**Total score**
Low	<2.0
Moderate	2.0–6.0
High	>6.0

If the pre-test probability for pulmonary embolism is high, a spiral-CT angiogram should be performed as the following step. If clinical signs suggest deep vein thrombosis of a leg, ultrasonography of the legs might confirm the diagnosis and obviate the need for a CT. Further investigation of the small pleural effusion by chest ultrasound and thoracentesis could follow if there was no evidence of pulmonary embolism.
A therapeutic approach using diuretics should not be attempted prior to the evaluation of pulmonary embolism in this patient with chest pain and pleural effusion.

References

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Tapson VF, *et al.* Acute pulmonary embolism. *N Engl J Med* 2008; 358: 1037–1052.

HERMES Syllabus link: 14 Pulmonary vascular diseases
Angoff rating: 69%

Question 136

An 83-year-old male patient is referred to you because of a cough that started 6 months ago. He brings up some yellow phlegm and he recently noticed a little blood staining within his phlegm. Furthermore, he felt extremely tired. He had consulted his family physician who had prescribed antibiotics for 10 days which did not change the cough but the colour of the phlegm turned white. The chest radiograph revealed an enlarged right hilum.
On further evaluation the patient complains about painful ankles and wrists, a diminished appetite and a weight loss of 5 kg in the last month. In the last month he lost a lot of energy, most of the day he is lying in his bed or sitting in a chair. He also needs some help with his personal hygiene. Further investigations revealed a squamous cell carcinoma of his right upper lobe and liver metastases.
Which one of the following would be your most appropriate next therapeutic option?

a. Best supportive care
b. Gemcitabin
c. Platinum containing doublet chemotherapy
d. Erlotinib
e. Bevacizumab

Correct answer

a. Best supportive care

This patient has stage IV squamous cell carcinoma with a poor performance score (World Health Organization (WHO)/Eastern Cooperative Oncology Group (ECOG) stage 3–4) for which (palliative) chemotherapy is not indicated, except erlotinib for epidermal growth factor receptor (EGFR) mutation positive patients. Because of the low incidence (less than 3.6%) of *EGFR* mutations, routine testing for them should not be performed. Two-drug regimens are preferred. A third drug improves only response rate, not survival. Platinum-based therapy prolongs survival, improves symptom control and quality of life in nonsmall cell lung cancer patients. In squamous cell carcinoma the gemcitabin/cisplatin combination shows superior efficacy compared with pemetrexed/cisplatin. Gemcitabin would be an adequate maintenance therapy after a platinum/gemcitabin doublet therapy in the absence of disease progression. Bevacizumab blocks the vascular endothelial growth factor and is a recommended option for fit patients (WHO/ECOG stage 0–1) with non-squamous cell carcinoma who are EGFR mutation negative. Bevacizumab is not a recommended treatment for squamous cell carcinoma.

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HERMES Syllabus link: 27 Associated specialties
Angoff rating: 59%

Question 137

A 54-year-old male is referred to you because of an unexpected finding on a chest CT performed after blunt chest trauma during a car accident. The lesion seen on the CT (below) extends about 1.5 cm above and 1.5 cm below the level shown in the figure. On consultation, the patient has no respiratory complaints but reports that he felt a little bit tired during the last month and had less energy. Walking was more difficult for him. His past medical history was uneventful. On physical examination no abnormalities were found. Haematology and chemistry including β-human chorionic gonadotropins (β-hCG), alpha fetoprotein and thyroid stimulating hormone (TSH) were normal.

Which one of the following is the next most appropriate step?

a. Bronchoscopy
b. Mediastinoscopy
c. Thoracotomy
d. Oesophageal ultrasound sonography
e. Transthoracic biopsy

Correct answer

c. Thoracotomy

The CT shows a solid mass in the anterior mediastinum. A thymoma is one of the possible diagnoses and teratoma and thyroid cancer are additional differential diagnoses. According to the National Comprehensive Cancer Network guidelines the next recommended step should be thoracotomy, since thymic malignancy is the most likely tumour. Bronchoscopy and endobronchial ultrasound will not be of any use, since the mass cannot be reached. Mediastinoscopy and transthoracic biopsy should be avoided if the tumour is resectable (evidence grade 2A).

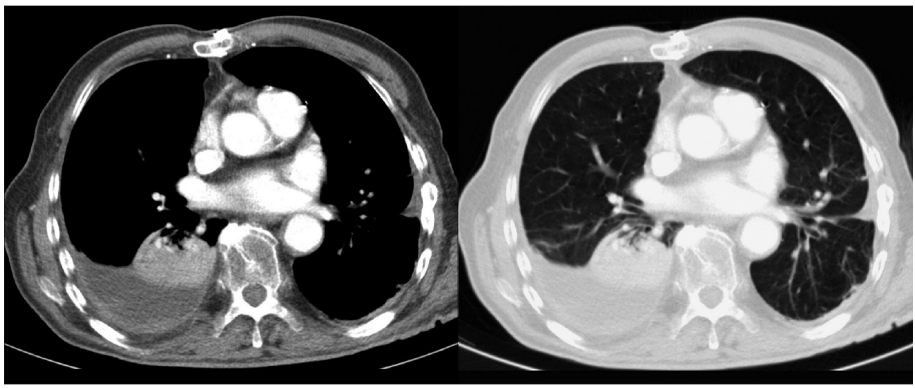
Reference

National Comprehensive Cancer Network. NCCN Clinical practice guidelines in oncology version 2.2011. National Comprehensive Cancer Network, 2011. Available from www.nccn.org

HERMES Syllabus link: 27 Associated specialties
Angoff rating: 46%

Question 138

A 56-year-old roofer undergoes a chest radiograph and, subsequently, a chest CT examination (below) because of persistent cough after a common cold. He is in good general health and physically fit.



Which one of the following statements regarding the parenchymal lesion shown in the CT is most appropriate?

a. It is associated with asbestos exposure.
b. Such lesions usually enlarge with time.
c. The typical location is in the upper lobes.
d. It represents a congenital malformation.
e. It should be explored surgically to rule out malignancy.

Correct answer

a. It is associated with asbestos exposure.

The chest CT shows typical characteristics of a rounded atelectasis including location in the lower lung lobe adjacent to the pleura, accompanying pleural effusion, a rounded or lentiform shape with soft tissue density, air bronchogram, folded vessels and bronchi that present as a 'comet tail'. Rounded atelectases are associated with asbestos exposure but may also appear following tuberculous pleuritis or after cardiac surgery. Since the patient worked as a roofer, he was likely exposed to asbestos at his work place. Other signs of previous asbestos exposure in this patient include dorsal thickening of the left-sided pleura and fibrous broadening the left lobar fissure. The size of rounded atelectasis is usually stable or decreases with time. Lung cancer is a differential diagnosis but surgical biopsy to rule out malignancy and confirm the diagnosis of rounded atelectasis is required only in cases that are not as characteristic as this one. Pulmonary sequestration, a congenital malformation with aberrant formation of lung tissue without connection to the bronchial tree, is also commonly located in the lower lobes but air bronchogram and pleural effusion are not features of sequestration.

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HERMES Syllabus link: 20 Pleural diseases, 15 Occupational diseases
Angoff rating: 55%

Question 139

A 59-year-old, overweight man suffers from newly diagnosed OSAS with daytime sleepiness. Based on randomised trials, which of the following benefits can treatment of his OSAS be expected to provide?

a. Prolonged survival
b. Enhanced quality of life
c. Reduced daytime sleepiness
d. Reduced risk of early-onset dementia

Correct answers

b. Enhanced quality of life
c. Reduced daytime sleepiness

Studies of CPAP therapy for OSAS have shown positive effects on blood pressure and cardiovascular risk; however, no controlled trial has shown a survival benefit and for ethical reasons this kind of study will also not be feasible in the future. Sleepiness and quality of life have been shown to improve with CPAP in several randomised controlled trials. Although OSAS may impair cognitive function, its treatment has not been shown to reduce the risk for early-onset dementia.

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HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 53%

Question 140

Which lung cancer cell type is most commonly associated with paraneoplastic hypercalcaemia?

a. Adenocarcinoma
b. Adenocarcinoma with lepidic growth
c. Large cell carcinoma
d. Small cell carcinoma
e. Squamous cell carcinoma

Correct answer

e. Squamous cell carcinoma

Paraneoplastic syndromes are signs or symptoms that occur as a result of organ or tissue damage at locations remote from the site of the primary tumour or metastases. The two most common paraneoplastic syndromes associated with lung cancer are humoral hypercalcaemia in squamous cell carcinoma and the syndrome of inappropriate antidiuretic hormone secretion in small cell lung cancer. The majority of humoral hypercalcaemia of malignancy cases are caused by the secretion of parathyroid hormone (PTH)-related protein (PTHrP) from the tumour. PTHrP has significant homology with PTH in the amino-terminal region, and both PTH and PTHrP bind to a common PTH/PTHrP receptor. Rare cases of hypercalcaemia with ectopic PTH secretion by lung cancers have also been reported. Another mechanism of humoral hypercalcaemia of malignancy may be mediated by granulocyte colony-stimulating factor (G-CSF). Long-term exposure to G-CSF results in the stimulation of osteoclastic bone resorption or an increase in osteoclast progenitors. Ectopic hormone production is uncommon in large cell carcinomas.

Reference

Kanaji N, *et al*. Paraneoplastic syndromes associated with lung cancer. *World J Clin Oncol* 2014; 5: 197–223.

HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 58%

Question 141

A 52-year-old female with a medical history of hypertension and hypercholesterolemia presents with progressive shortness of breath. She is an ex-smoker (she quit smoking 15 years ago) with a 20 pack-year smoking history. Approximately 1 year ago she began to notice shortness of breath on exertion.

She was initially seen by her family doctor and prescribed bronchodilators, with no clear improvement. When her symptoms got worse, with fatigue and dizziness in addition to shortness of breath during usual everyday activities such as shopping or climbing stairs, she was referred to a cardiologist for further evaluation.

A transthoracic echocardiogram was performed with the following findings: estimated pulmonary artery systolic pressure of 70 mmHg, right ventricular dilatation with hypokinesis. Normal left ventricular size and function, with an ejection fraction of 55%.

Which of the following examinations should be included in the further diagnostic evaluation of this patient?

a. Pulmonary function tests
b. HRCT of the chest
c. Ventilation/perfusion lung scan
d. Open or thoracoscopic lung biopsy

Correct answers

a. Pulmonary function tests
b. HRCT of the chest
c. Ventilation/perfusion lung scan

Pulmonary hypertension (PH) is defined as an increase in mean pulmonary arterial pressure of ≥25 mmHg at rest, as assessed by right heart catheterisation. The recent guidelines on PH from the European Society of Cardiology and the European Respiratory Society propose a diagnostic algorithm for patients with symptoms, signs and history suggestive of PH (figure).

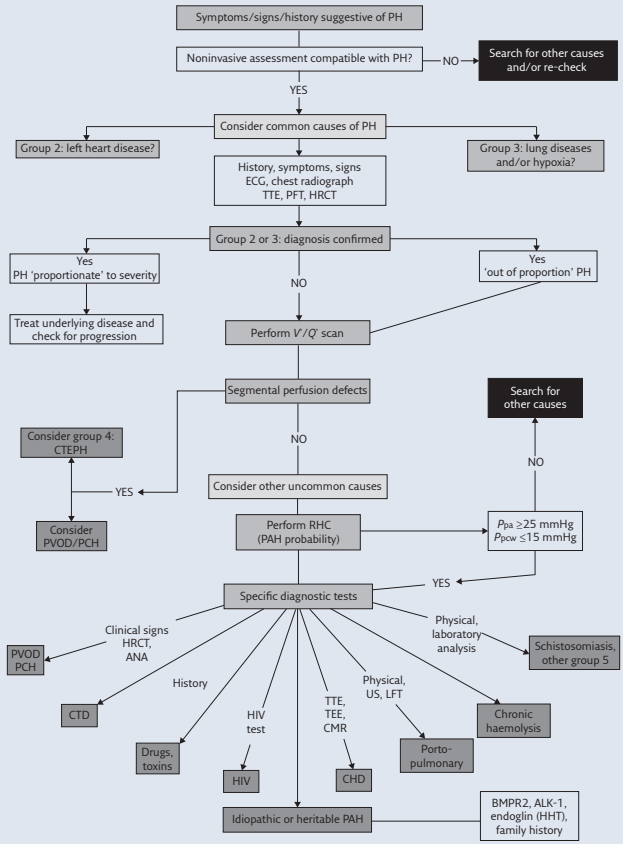

FIGURE 2. Diagnostic algorithm for patients with symptoms, signs and history suggestive of PH. ALK-1: activin-receptor-like kinase; ANA: anti-nuclear antibodies; BMPR2: bone morphogenetic protein receptor 2; CHD: congenital heart disease; CMR: cardiac magnetic resonance; CTD: connective tissue disease; HHT: hereditary haemorrhagic telangiectasia; LFT: liver function tests; P_{pa}: mean pulmonary arterial pressure; PAH: pulmonary arterial hypertension; PCH: pulmonary capillary haemangiomatosis; P_{pcw}: pulmonary capillary wedge pressure; PFT: pulmonary function test; PVOD: pulmonary veno-occlusive disease; RHC: right heart catheterisation; TEE: transoesophageal echocardiography; TTE: transthoracic echocardiography; US: ultrasonography; *V'/Q'*: ventilation/perfusion lung scan. Reproduced from the ESC/ERS/ISHLT Guidelines (2009).

If noninvasive assessment is compatible with PH, clinical history, symptoms, signs, ECG, chest radiograph, transthoracic echocardiogram, pulmonary function tests and HRCT of the chest

are requested to evaluate the presence of group 2 (left heart diseases) or group 3 (lung diseases) PH. If these are not found or if PH seems 'out of proportion' to their severity, less common causes of PH should be looked for. Ventilation/perfusion lung scan should be considered. Multiple segmental perfusion defects would be consistent with the diagnosis of group 4 chronic thromboembolic pulmonary hypertention (CTEPH). The final diagnosis of CTEPH would require a CT pulmonary angiography, right heart catheterisation and selective pulmonary angiography. If a ventilation/perfusion scan is normal or shows only subsegmental 'patchy' perfusion defects, a tentative diagnosis of group 1 PH (pulmonary arterial hypertension) or the rarer conditions (group 5 PH) is made. Additional specific diagnostic tests including haematology, biochemistry, immunology, serology and ultrasonography will allow the final diagnosis to be refined. Open or thoracoscopic lung biopsy entails substantial risk of morbidity and mortality. Because of the low likelihood of altering the diagnosis and treatment, routine biopsy is discouraged in patients with suspected pulmonary arterial hypertension.

References

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HERMES Syllabus link: 14 Pulmonary vascular diseases
Angoff rating: 55%

Question 142

A 47-year-old clothes salesman presents with dyspnoea on exertion that has developed over the past 6 months. He is a current smoker with a smoking history of 30 pack-years. He receives an angiotensin-converting enzyme inhibitor for hypertension and occasionally takes ibuprofen for joint pains. He has no history of relevant exposure to environmental toxins or dust. His physical examination reveals bilateral, basal, fine, end-inspiratory crackles of Velcro type and clubbing of the fingers. His S_{pO_2} on room air is 95%, but falls to 82% during a 6-min walk test. Spirometry shows a FEV_1 of 74% predicted, a FVC of 68% predicted and an FEV_1/FVC ratio of 88%. T_{LCO} is 42% predicted. A recent HRCT scan of the chest shows bilateral reticular opacities with honeycombing, predominantly in the periphery of the lung bases.
Which one of the following is the most appropriate next step?

a. Positron emission tomography scan
b. Serum levels of surfactant proteins A and D
c. Video-assisted thoracoscopic lung biopsy
d. Transbronchial lung biopsy and bronchoalveolar lavage
e. Laboratory tests for connective tissue diseases

Correct answer

e. Laboratory tests for connective tissue diseases

This patient has a history, physical examination, pulmonary function tests and radiological features strongly suggestive of idiopathic pulmonary fibrosis, *i.e.* clubbing, Velcro rales, diffuse parenchymal lung disease with lower lobe predominance and honeycombing in the absence of clear features suggestive of other specific lung diseases. In such patients, especially in those aged <50 years and with a history of arthritis, the presence of connective tissue disorders such as scleroderma, dermatomyositis and chronic polyarthritis should be evaluated by clinical examination and laboratory tests. Laboratory tests should include rheumatoid factors, anti-cyclic citrullinated peptide, and anti-nuclear antibody titre and pattern. Bronchoalveolar lavage is not necessary for the diagnosis but may be indicated to search for infection if clinically suspected. Bronchoalveolar lavage may also give a diagnostic hint if exposure to organic dust or drugs (such as amiodarone, for example) suggests possible subacute or chronic hypersenstivitiy pneumonia. In this case, pronounced lymphocytosis may be present. Surgical biopsies are not necessary for the diagnosis of idiopathic pulmonary fibrosis in this typical presentation but may help to differentiate usual interstitial pneumonitis from other forms of interstitial pneumonitis in less characteristic cases. Transbronchial biopsies may show histological features of usual interstitial pneumonitis but the sensitivity and specificity of this approach for the diagnosis for idiopathic pulmonary fibrosis is insufficient. Serum biomarkers such as surfactant protein A and D or matrix metalloproteinase may be correlated with disease progression and prognosis but there is not enough evidence to advocate their use in clinical patient management. Positron emission tomography has no role in the evaluation of patients with suspected pulmonary fibrosis unless there is concomitant cancer that requires staging.

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HERMES Syllabus link: 10 Interstitial lung diseases
Angoff rating: 54%

Question 143

Which of the following statements about central sleep apnoea, Cheyne–Stokes respiration and periodic breathing is/are correct?

a. Circulatory delay contributes to the development of Cheyne–Stokes respiration.
b. In Cheyne–Stokes respiration, during sleep, P_{aCO_2} transiently falls below the critical P_{aCO_2} required for respiratory rhythm generation.
c. Periodic breathing at altitude is associated with a low P_{aCO_2}.
d. Cheyne–Stokes respiration can trigger sympathetic nervous activation and, thereby, exert a secondary deleterious effect on the underlying cardiac disorder.

Correct answers

a. Circulatory delay contributes to the development of Cheyne–Stokes respiration.
b. In Cheyne–Stokes respiration, during sleep, $P_{a}CO_2$ transiently falls below the critical $P_{a}CO_2$ required for respiratory rhythm generation.
c. Periodic breathing at altitude is associated with a low $P_{a}CO_2$.
d. Cheyne–Stokes respiration can trigger sympathetic nervous activation and, thereby, exert a secondary deleterious effect on the underlying cardiac disorder.

Cheyne–Stokes respiration is a form of periodic breathing consisting of a waxing and waning pattern of hyperpnoea alternating with central apnoea. Factors contributing to the hyperpnoea or hyperventilation include pulmonary congestion in heart failure, increased chemosensitivity and recurrent arousals from sleep. Central apnoea occurs when carbon dioxide tension is driven below the apnoeic threshold. Ventilatory control in chronic heart failure is disrupted further by circulatory delay in low cardiac output states. Excessive sympathetic outflow complicates Cheyne–Stokes respiration, and is caused by recurrent hypoxia and respiratory arousals. This sympathetic overactivity may exacerbate the decline in cardiac function.
At altitude, hypoxia stimulates ventilation resulting in hypocapnia and a periodic pattern of breathing.

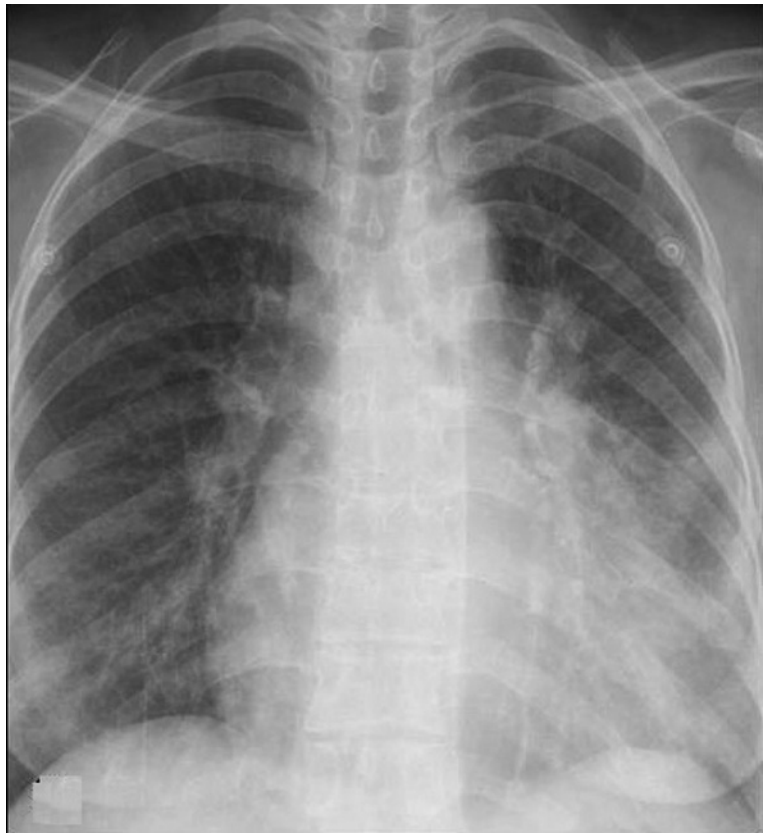
Reference

Bradley TD, *et al*. Sleep apnea and heart failure. Part II: Central sleep apnea. *Circulation* 2003; 107: 1822–1826.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 58%

Question 144

A 45-year-old woman with a history of severe asthma and allergic rhinitis presents with a 2-week history of central chest pain aggravated by coughing, fever and haemoptysis. The chest radiograph is shown below. Her ECG fulfils criteria for low voltage. Her white blood cell count is 11×10^9 per L with 18% eosinophils.



What is the most likely diagnosis?

a. Allergic bronchopulmonary aspergillosis
b. Eosinophilic granulomatosis with polyangiitis
c. Chronic eosinophilic pneumonia
d. Hypereosinophilic syndrome
e. Pulmonary embolism

Correct answer

b. Eosinophilic granulomatosis with polyangiitis

Pulmonary diseases associated with tissue and/or blood eosinophilia are a heterogeneous group of disorders. Especially in asthmatic patients, the most frequent disorders associated with eosinophilia are chronic eosinophilic pneumonia (CEP), eosinophilic granulomatosis with polyangiitis (EGPA) and allergic bronchopulmonary aspergillosis (ABPA).

The clinical presentation of this case with pulmonary and cardiac involvement (pulmonary infiltrates and enlarged cardiac silhouette in the chest radiograph, and low ECG voltage) is suggestive of EGPA. Unlike EGPA, which also has extrapulmonary features such as sinusitis, neurological manifestations (mononeuropathy), skin and cardiovascular involvement (heart failure, myocarditis, pericarditis, constrictive pericarditis and myocardial infarction), in CEP and ABPA, there is only pulmonary involvement. Hypereosinophilic syndrome is defined by an absolute eosinophil count $>1.5\times10^6$ per L that persists for >6 months and usually has predominant cardiac (myocardial fibrosis, mitral and tricuspid valve dysfunction, and congestive heart failure) rather than pulmonary involvement. Finally, in pulmonary embolism, the presenting symptoms are usually pleuritic chest pain, shortness of breath and hypoxia, while in ECG, the most common abnormalities are tachycardia and nonspecific ST-T wave abnormalities. Eosinophilia and pericardial effusion are rarely seen in pulmonary embolism.

Corticosteroids are usually adequate for the treatment of EGPA. Major life-threatening organ involvement (such as cardiac involvement) may require treatment with pulsed doses of intravenous corticosteroids and cytotoxic agents. Cyclophosphamide is typically given in intravenous pulses for 3 months; afterward, patients are switched to either oral mycophenolate or azathioprine. Chronic eosinophilic pneumonia responds well to glucocorticoid treatment but often relapses. ABPA also responds well to glucocorticoids but when relapsing anti-fungal treatment such as itraconazole should be considered. In hypereosinophilic syndrome glucocorticoids are the first-line therapy, although one third of these cases do not respond. In such patients, interferon-α, hydroxyurea and imatinib are second-line drugs.

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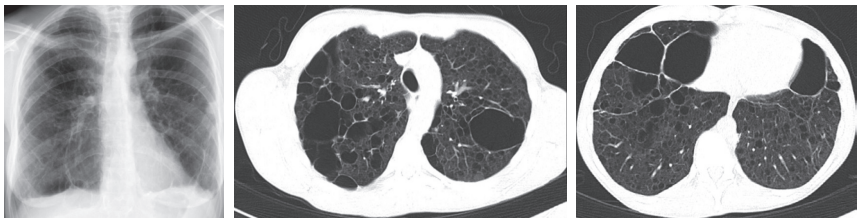
Noth I, *et al.* Churg–Strauss syndrome. *Lancet* 2003; 361: 587–594.

HERMES Syllabus link: 12 Eosinophilic diseases
Angoff rating: 50%

Question 145

A 38-year-old nonsmoking woman had a left-sided pneumothorax that was successfully treated by drain insertion. Her chest radiograph and chest CT are shown below.



Which one of the following is the most likely diagnosis?

a. Emphysema due to α_1-antitrypsin deficiency
b. Langerhans' cell histiocytosis
c. Lymphangioleiomyomatosis
d. Lymphocytic interstitial pneumonitis with cysts
e. Usual interstitial pneumonitis with honeycombing

Correct answer

c. Lymphangioleiomyomatosis

This young nonsmoking woman has radiographic features of thin-walled cysts and a history of pneumothorax. This makes the diagnosis of lymphangioleiomyomatosis (LAM) most likely. The diagnosis of LAM should be strongly suspected in any young woman with emphysema-like changes of the lung parenchyma, recurrent pneumothoraces and/or chylous pleural effusion, and potentially some extrapulmonary findings such as renal angiomyolipomas, tuberous sclerosis or chyloperitoneum. In the presence of a typical radiological pattern and clinical findings, lung biopsy might not be necessary for the diagnosis of LAM. Genetically, *TSC* mutations might be involved.

Unfortunately, there is no medical therapy of proven benefit in pulmonary LAM and, thus, supportive care and the prevention or prompt treatment of complications are the cornerstones of management. It is highly recommended that patients stop smoking; further measures are supplemental oxygen in patients with low P_{aO_2}, pulmonary rehabilitation or the use of bronchodilators in the case of airway obstruction. Oestrogen therapy should be avoided. Studies using mTOR inhibitors, such as sirolimus and everolimus, are promising, and referral for lung transplantation should be considered in any patient with worsening symptoms/clinical status.

References

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HERMES Syllabus link: 10 Interstitial lung disease, 25 Orphan and rare lung diseases, 26 Genetic and developmental disorders
Angoff rating: 55%

Question 146

A 39-year-old female presents with painful erythema nodosum. Her physical examination is unremarkable and her S_{pO_2} on room air is 98%. Her chest radiograph shows bilateral hilar lymphadenopathy. Spirometry reveals an FEV_1 of 79% predicted, an FVC of 89% predicted and an FEV_1/FVC ratio of 77%, with a T_{LCO} of 82% predicted.
Which one of the following would be the most appropriate next step?

a. A lymph node biopsy
b. Bronchoscopy with bronchoalveolar lavage
c. A biopsy from the skin lesions
d. Treatment with nonsteroidal anti-inflammatory drugs
e. Treatment with systemic corticosteroids

Correct answer

d. Treatment with nonsteroidal anti-inflammatory drugs

This patient has a clinical presentation highly suggestive of acute sarcoidosis with Löfgren's syndrome. The syndrome typically occurs in women and includes erythema nodosum, bilateral hilar lymphadenopathy, migratory polyarthralgias and fever. The prognosis is good and spontaneous remissions commonly occur. Biopsy confirmation revealing noncaseating granulomas is usually not necessary in this condition. Bronchoscopy with bronchoalveolar lavage revealing an elevated lymphocyte count with a CD4/CD8 ratio >3.5 may be indicative of a diagnosis of sarcoidosis, but again is not necessary in this patient. Biopsies from erythema nodosum skin lesions do not provide evidence of noncaseating granulomas and are not recommended in the context of suspected sarcoidosis. Inhaled corticosteroids may help for the suppression of cough and nonsteroidal anti-inflammatory drugs may relieve her from the painful lesions of erythema nodosum. No other treatment is indicated in this patient with mildly impaired lung function.

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Wells AU, *et al.* Interstitial lung disease guideline: the British Thoracic Society in collaboration with the Thoracic Society of Australia and New Zealand and the Irish Thoracic Society. *Thorax* 2008; 63: Suppl. 5, v1–v58.

HERMES Syllabus link: 10 Interstitial lung disease
Angoff rating: 59%

Question 147

A 58-year-old male is referred for haemoptysis. His chest radiograph is shown below.

His S_{pO_2} is 87%. Urine analysis reveals microscopic haematuria; 60% of the erythrocytes are of glomerular origin. Creatinine clearance is 27 mL·min^{-1}. Perinuclear anti-neutrophil cytoplasmic antibody (myeloperoxidase) titre is elevated in the serum.
What is the first-choice treatment for this patient?

a. High-dose intravenous corticosteroids
b. Rituximab
c. Etanercept and high-dose corticosteroids
d. Plasma exchange and high-dose corticosteroids
e. Cyclophosphamide and high-dose corticosteroids

Correct answer

e. Cyclophosphamide and high-dose corticosteroids

This patient suffers from microscopic polyangiitis, an anti-neutrophil cytoplasmic antibody-associated systemic vasculitis that involves the lung and the kidney. Haemoptysis is due to pulmonary capillaritis with alveolar haemorrhage. The kidneys are damaged by focal segmental necrotising glomerulonephritis that causes haematuria and renal failure. The appropriate therapy to improve renal failure and alveolar haemorrhage consists of an urgent pulsed therapy with parenteral cyclophosphamide and high-dose corticosteroids. High-dose intravenous corticosteroids might induce remission but will not prevent relapse. Although B-cell directed therapy with the monoclonal antibody rituximab has been shown to be noninferior to cyclophosphamide in inducing remission and possibly even superior in prevention of relapse, the role of rituximab remains to be fully elucidated. Rituximab, etanercept and plasma exchange may be applied as rescue therapies if cyclophosphamide and corticosteroids fail; however, Rituximab as monotherapy is not indicated.

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HERMES Syllabus link: 5 Treatment modalities and prevention measures, 14 Pulmonary vascular diseases
Angoff rating: 54%

Question 148

A 40-year-old asthmatic woman has a follow-up visit to your office because of an acute exacerbation without obvious cause. She is compliant to her medication and her inhalation technique is correct. 2 weeks ago, she was prescribed prednisone tablets 40 mg per day for 5 days and her inhalation therapy was intensified by increasing the dose of budesonide/formoterol 200/6 ng from two to eight inhalations per day. Currently, she feels well. Her dyspnoea and cough have completely disappeared and she is not impaired in her usual daily activities as a nurse. Her current peak flow values are near her personal best of 420 $L \cdot min^{-1}$. Her FEV_1 has increased from 48% predicted 2 weeks ago to 98% predicted now.
What is the recommended next step?

a. Reduce budesonide/formoterol to two inhalations per day now.
b. Continue budesonide/formoterol at eight inhalations per day.
c. Reduce budesonide/formoterol to four inhalations per day.
d. Reduce budesonide/formoterol to four inhalations per day in 2 months.
e. Reduce budesonide/formoterol to two inhalations daily in 2 months.

Correct answer

c. Reduce budesonide/formoterol to four inhalations per day.

According to the Global Initiative for Asthma, asthma is managed by stepwise therapy in which the dose of medication, the number of medications and/or the frequency of administration are increased as necessary and decreased when possible. Asthma control is thereby assessed irrespectively of medication use, based on the current level of symptoms, FEV_1 or peak expiratory flow values, and number of exacerbations requiring oral glucocorticoids per year. The goal of asthma therapy is the freedom from frequent or troublesome symptoms of asthma (cough, chest tightness, wheezing or shortness of breath) and the prevention of exacerbations. It should thus encompass:

- Minimal need (≤2 days per week) of inhaled short-acting β-agonists to relieve symptoms.
- Few night-time awakenings (fewer than two nights per month) due to asthma
- Optimisation of lung function
- Maintenance of normal daily activities, including work or school attendance, and participation in athletics and exercise
- Satisfaction with asthma care on the part of patients and families

This patient has unstable asthma as she just recently had an exacerbation without obvious cause. Her inhalation is correct and her compliance to using her medication is good. Therefore, after the short-term use of very high doses of budesonide/formoterol, her medications should be reduced to lower doses but it should be higher than the previous maintenance dose, *i.e.* increased from two to four inhalations per day, for at least 2–3 months.

References

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HERMES Syllabus link: 6 Airway diseases
Angoff rating: 59%

Question 149

Which of the following statements concerning pleural effusion is/are true?

a. Pulmonary embolism may cause exudative or transudative pleural effusions.
b. Benign asbestos pleural effusions are transudates.
c. Effusions after coronary bypass surgery are most frequently bilateral.
d. Pleural effusions due to pancreatitis are typically right sided.

Correct answer

a. Pulmonary embolism may cause exudative or transudative pleural effusions.

Pleural effusion is an indicator of an underlying disease process that may be pulmonary or non-pulmonary in origin and may be acute or chronic. Pleural effusions are generally classified as transudates or exudates based on the mechanism of fluid formation and pleural fluid chemistry. Transudates result from an imbalance in oncotic and hydrostatic pressures, whereas exudates are the result of inflammation of the pleura or decreased lymphatic drainage.

The fluid is considered an exudate if any of the following are found: 1) Ratio of pleural fluid to serum protein >0.5; 2) ratio of pleural fluid to serum lactate dehydrogenase (LDH) >0.6; and 3) pleural fluid LDH more than two-thirds the upper limit of the normal serum value. The fluid is considered a transudate if all of these are absent.

Pulmonary embolism is the fourth leading cause of pleural effusion. The mechanism is usually increased interstitial fluid in the lungs as a result of ischaemia or the release of vasoactive cytokines. Pleural effusion resulting from a pulmonary embolism usually occupies less than one-third of the hemithorax. Pleural fluid caused by pulmonary emboli is usually exudative but occasionally transudative.

The most common pathological pulmonary response to asbestos inhalation is the development of pleural plaques. Over time, collagen is deposited in the pleura and may calcify. Most plaques are completely asymptomatic. Benign asbestos pleural effusions, which are usually unilateral, are the most common manifestation of asbestos-related pleural disease within 10–20 years after exposure. Asbestos pleural effusions are usually exudative. However, in cases of exudative pleural effusions, a pleural biopsy may be needed to test for tuberculosis and malignancy. Furthermore, pleural effusion with pleuritic pain may be a manifestation of malignant mesothelioma.

Pleural effusions significant enough to require drainage develop in 6–7% of patients who undergo coronary artery bypass grafting with or without valve surgery. Pleural effusion is more frequent in women and in patients with heart failure, peripheral vascular disease or atrial fibrillation. The pleural effusions are usually unilateral, exudative according to Light's criteria and, in 50% of cases, are haemorrhagic. Pleural fluid from effusions occurring >15 days post-operatively are predominantly lymphocytic, whereas earlier effusions are primarily neutrophilic.

Abnormal chest radiographic findings can be seen in up to 55% of patients with acute pancreatitis and include pleural effusion, pulmonary infiltrates and pulmonary oedema-related to acute respiratory distress syndrome. Pleural effusion has been reported in 4–20% of pancreatitis patients and is considered an indication of severe pancreatitis, not just a marker of the disease. Pleural effusions in acute pancreatitis are usually small, occasionally bloody and are characterised by high amylase (up to 30 times greater than corresponding serum value), protein (>30 $g \cdot L^{-1}$) and LDH (>0.6 times the serum value) levels. The majority of pleural effusions (68%) are left sided, 22% are bilateral and only 10% are right sided. Two main causes of pleural effusion are transdiaphragmatic lymphatic blockage or pancreatic–pleural fistulae secondary to leak and disruption of the pancreatic duct or pseudocyst caused by an episode of acute pancreatitis.

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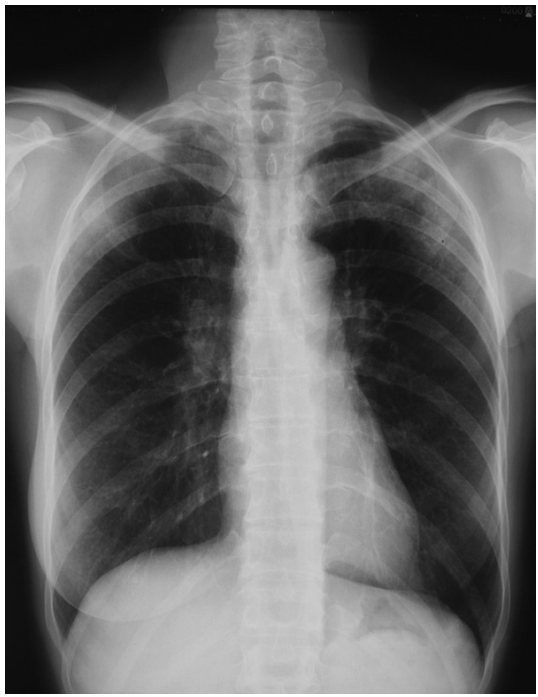
Loddenkemper R. Pleural effusion. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 428–431.

HERMES Syllabus link: 20 Pleural diseases
Angoff rating: 62%

Question 150

A 45-year-old female with a long history of mild asthma presents with cough, dyspnoea and fever of 18 days' duration. On examination, her chest is clear but the chest radiograph shows bilateral peripheral infiltrates (below). Laboratory tests reveal an eosinophil count of 8000 cells per mm^3, erythrocyte sedimentation rate of 65 mm in the first hour, mildly elevated total IgE and weakly positive *Aspergillus* precipitins. The chest radiograph is shown below.



Which one of the following is the most likely diagnosis?

a. Eosinophilic granulomatosis with polyangiitis
b. Allergic bronchopulmonary aspergillosis
c. Chronic eosinophilic pneumonia
d. Hypereosinophilic syndrome
e. Löffler's syndrome

Correct answer

c. Chronic eosinophilic pneumonia

Chronic eosinophilic pneumonia (CEP), eosinophilic granulomatosis with polyangiitis (EGPA) and allergic bronchopulmonary aspergillosis (ABPA) often occur in asthmatics. However, in CEP, there is only pulmonary involvement, unlike EGPA, which also has extrapulmonary features such as sinusitis, neurologic manifestations (mononeuropathy), and skin and cardiovascular involvement. In EGPA, the total IgE is markedly raised and anti-neutrophil cytoplasmic antibodies (MPO-ANCA or P-ANCA) are present in about 50% of cases. In ABPA, the eosinophil count is less markedly elevated but total and *Aspergillus*-specific IgE levels are both increased. The chest radiograph may suggest central bronchiectasis. Hypereosinophilic syndrome usually has cardiac rather than pulmonary involvement. CEP responds well to steroid treatment, but often relapses. EGPA may need immunosuppressive treatment in addition to steroids, usually azathioprine. ABPA also responds well to steroids but relapses indicate the need to consider anti-fungal treatment such as itraconazole. Löffler's syndrome refers to transient pulmonary infiltrates associated with blood eosinophilia due to *Ascaris*.

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HERMES Syllabus link: 12 Eosinophilic diseases
Angoff rating: 46%

Question 151

Which one of the following correctly defines oxygen delivery (DO_2)?

a. $DO_2 = \frac{(MAP - RAP)}{CO}$

b. $DO_2 = \frac{(MAP - PCWP)}{CO}$

c. $DO_2 = CaO_2 \cdot CO$

d. $DO_2 = 1.36 \cdot Hb \cdot SaO_2$

e. $DO_2 = Sa\text{-}vO_2 \cdot CO$

MAP: mean arterial pressure; RAP: right atrial pressure; CO: cardiac output; PCWP: pulmonary capillary wedge pressure; CaO_2: arterial oxygen content; $Sa\text{-}vO_2$: arterial–central venous oxygen saturation difference.

Correct answer

c. $D_{O_2} = C_{aO_2} \cdot CO$

D_{O_2} describes the amount of oxygen that is transported to the tissues *via* the circulatory system. It depends on C_{aO_2} and CO (formula c). Formula a defines systemic vascular resistance and formula b, pulmonary vascular resistance. Formula d almost correctly defines C_{aO_2} but it includes only the oxygen bound to Hb and not the dissolved oxygen. The correct formula for C_{aO_2} is:

$$C_{aO_2} = S_{aO_2} \cdot Hb \cdot 1.34 + P_{aO_2} \cdot 0.0031$$

Formula e defines oxygen consumption.

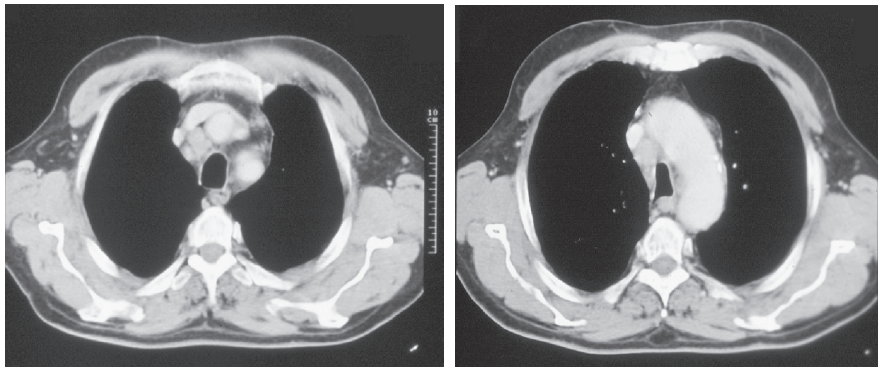
Reference

Sramek BB. Systemic Hemodynamics and Hemodynamic Management. Collierville, Instant Publisher, 2002.

HERMES Syllabus link: 1 Structure and function of the respiratory system, 4 Other diagnostic procedures, 27 Associated specialties
Angoff rating: 60%

Question 152

In a 73-year-old, otherwise healthy, heavy smoker with normal lung function, endobronchial biopsy of a tumour in the left lower lobe reveals non-small cell lung cancer. CT images are shown below.



Which one of the following is the most appropriate next action?

a. Transthoracic fine-needle aspiration of lymph nodes
b. Surgical resection
c. Endobronchial ultrasound-guided biopsy of lymph nodes
d. Positron emission tomography CT
e. MRI of the brain

Correct answer

d. Positron emission tomography CT

There is a tumour in the left lower lobe and the CT scan shows enlarged lymph nodes >1 cm on the contralateral side (on the right). Information on these lymph nodes and on potential distant metastases is important in planning further therapy. Positron emission tomography (PET)-CT should be performed as the next step for further staging of the cancer. If the right-sided lymph nodes are malignant, N3 status will be present. Curative surgery in this setting is not feasible. Thus, in the case of positive lymph nodes on PET-CT, cytological or histological confirmation of malignancy should be sought by endobronchial ultrasound-guided transbronchial fine-needle aspiration. Transthoracic fine-needle aspiration of mediastinal lymph nodes is not appropriate.

Reference

Vansteenkiste J, *et al*. Lung cancer: diagnosis and staging. *In:* Palange P, *et al*., eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 455–459.

HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 63%

Question 153

A 64-year-old alcoholic has jaundice and minimal ascites. He reports that he has smoked an average of one pack of cigarettes a day for 40 years. His total serum bilirubin is 240 mmol·L^{-1} (normal range 3–26 mmol·L^{-1}). His arterial blood gas values are P_{aO_2} 4.9 kPa (37 mmHg), P_{aCO_2} 4.2 kPa (32 mmHg) and pH 7.45. He is given nasal oxygen at a flow rate of 4 L·min^{-1}, and a repeat blood gas reveals P_{aO_2} 5.8 kPa (44 mmHg), P_{aCO_2} 4.6 kPa (35 mmHg) and pH 7.43. Spirometry and chest radiography are normal.
To which one of the following is the hypoxaemia is most likely due?

a. Ascites and hepatomegaly causing poor gas exchange at the lung bases
b. Unrecognised subpulmonic effusion
c. Pulmonary arteriovenous shunts
d. Unrecognised microatelectasis
e. Pulmonary hypertension

Correct answer

c. Pulmonary arteriovenous shunts

Hepatopulmonary syndrome is defined by the triad of liver disease, impaired oxygenation and intrapulmonary arteriovenous shunts, referred to as intrapulmonary vascular dilatations. Impaired oxygenation is due to right-to-left shunting through these vascular dilatations. Severe hypoxaemia (P_{aO_2} <6.7 kPa (<50 mmHg)) that is not corrected by oxygen supplementation in the presence of normal spirometry and chest radiography is strongly suggestive of hepatopulmonary syndrome. Contrast-enhanced echocardiography is the method of choice to confirm the presence of intrapulmonary shunt but technetium-labelled macroaggregated albumin nuclear scanning or pulmonary angiography can also be used.
Massive ascites and hepatomegaly, subpulmonic effusion, and microatelectasis are associated with a milder degree of hypoxaemia that improves with oxygen supplementation. In addition, a large pleural effusion and/or atelectasis that would induce severe hypoxaemia will be associated with a significant loss of lung volume and radiographic abnormalities. Pulmonary hypertension secondary to liver disease might be associated with normal lung volumes and a normal chest radiograph but with only mild hypoxaemia that aggravates during exercise.

References

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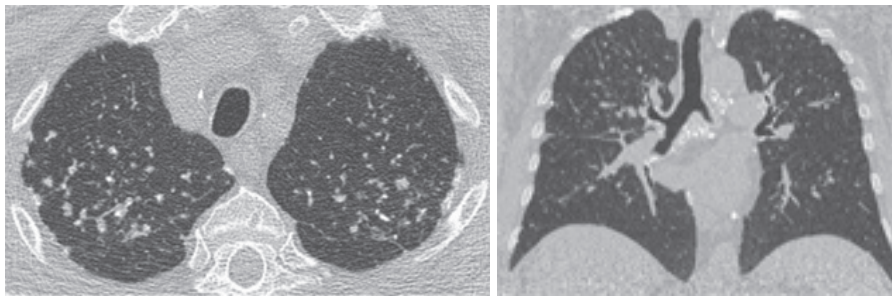
HERMES Syllabus link: 13 Respiratory consequences of systemic/extrapulmonary disorders, 14 Pulmonary vascular diseases
Angoff rating: 57%

Question 154

A 50-year-old stone-mason is referred for a mild chronic cough. He does not smoke and his medical history is unrevealing. His chest radiograph shows several small rounded opacities in both upper lung fields. Retrospectively, the same changes can be found on the chest radiograph taken by his family physician 2 years ago. A chest CT is performed (see figure). Pulmonary function testing reveals mild irreversible airway obstruction.



Which measure should be taken to avoid progression of the patient's lung disease?

a. Start daily inhalation with tiotropium bromide.
b. Screen for α_1-antitrypsin deficiency.
c. Employ rigorous dust protection at the patient's work place.
d. Start systemic steroid therapy.
e. Examine sputum for acid-fast bacilli.

Correct answer

c. Employ rigorous dust protection at the patient's work place

Considering the occupational exposure to silica dust as a stone mason and the radiological findings of small nodules predominantly in the upper lobes, this patient most likely suffers from mild silicosis. Thus, occupational dust protection is key to avoid further progression of silicosis. Since the nodules had already been found in a chest radiograph taken 2 years earlier, active tuberculosis is unlikely. Bronchodilator therapy may improve the cough, but will have no impact on the course of silicosis. Neither screening for α_1-antitrypsin deficiency nor systemic steroid therapy is indicated in mild chronic airway obstruction. And this patient has no characteristics suggesting sarcoidosis or other disease requiring systemic steroids.

References

Adverse effects of crystalline silica exposure. American Thoracic Society Committee of the Scientific Assembly on Environmental and Occupational Health. *Am J Respir Crit Care Med* 1997; 155: 761–768.

Sirajuddin A, *et al*. Occupational lung disease. *J Thorac Imaging* 2009; 24: 310–320.

HERMES examination blueprint: 10 Interstitial lung disease, 15 Occupational diseases
Angoff rating: 69%

Question 155

A 45-year-old man was discharged from the hospital 6 weeks ago after an asthma attack that had required intubation and mechanical ventilation. He is now in your office for a follow-up examination. He reports being free of symptoms and he is in good general condition. Pulmonary auscultation reveals bilateral wheezing. Spirometry shows an FEV_1 of 75% predicted; on hospital discharge, his FEV_1 was 96% predicted.
You obtain additional information during the consultation.
Which of the following suggest(s) that the patient is at risk of a fatal asthma attack?

a. Allergy to sea food
b. Emergency room treatment for asthma 8 months ago
c. Discontinuation of inhaled steroids 5 days ago
d. Lack of a written asthma plan

Correct answers

a. Allergy to sea food
b. Emergency room treatment for asthma 8 months ago
c. Discontinuation of inhaled steroids 5 days ago
d. Lack of a written asthma plan

Asthma mortality peaked in the 1990s and although the mortality rate has declined continuously since then, 6–23 patients per million of the population still die from asthma. The most relevant risk factors are a history of poorly controlled asthma and prior near-fatal asthma attacks. Minor risk factors include illicit drug abuse, psychosocial problems and socioeconomic factors. The increased death rate in African Americans is not explained by racial differences but by lower socioeconomic status. The risk of (near-)fatal asthma should be assessed by specifically evaluating associated factors listed in the table.

Table Factors that increase the risk of near-fatal death

A history of near-fatal asthma requiring intubation and mechanical ventilation
Hospitalisation or emergency care visit or asthma in the past year
Currently using or recently having stopped using oral corticosteroids (a marker of event severity)
Not currently using inhaled corticosteroids
Overuse of short-acting β-adrenergic agonists, especially use of more than one canister of salbutamol (or equivalent) monthly
A history of psychiatric disease or psychosocial problems
Poor adherence to asthma medications and/or poor adherence to (or lack of) a written asthma action plan
Food allergy in a patient with asthma

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References

Global Initiative for Asthma. Global Strategy for Asthma Management and Preventions. www.ginasthma.org/local/uploads/files/GINA_Report_2015_May19.pdf Date last updated: May 19, 2015.

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Eisner MD, *et al.* Risk factors for hospitalization among adults with asthma: the influence of sociodemographic factors and asthma severity. *Respir Res* 2001; 2: 53–60.

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HERMES Syllabus link: 6 Airway diseases
Angoff rating: 62%

Question 156

A 72-year-old male smoker with COPD was admitted to the hospital 2 days ago with a patchy right lower lobe pneumonia accompanied by fever, increased cough and dyspnoea. A sputum Gram stain showed Gram-positive cocci in pairs. He required oxygen (2 $L \cdot min^{-1}$) and was treated with intravenous ceftriaxone. Now, on the third day in the hospital, he is afebrile (for the past 24 h), has good oral intake, has no cough or sputum, and is not short of breath or tachypnoeic. His oxygen saturation on room air is 94%. A repeat chest radiograph shows a slight increase in the size of his right lower lobe infiltrate compared to his admission chest radiograph.
What is the best clinical approach in the management of this patient?

a. Order a CT scan of the chest
b. Continue *i.v.* ceftriaxone
c. Change therapy to *i.v.* erythromycin and imipenem
d. Switch to oral therapy with amoxicillin
e. Order bronchoscopy

Correct answer

d. Switch to oral therapy with amoxicillin

This patient has COPD and community-acquired pneumonia (CAP). The Gram stain indicates that the patient is infected by *Streptococcus pneumoniae*, which is the most likely infective organism in the described setting. Considering the fact that the patient improves clinically on the described monotherapy with *i.v.* ceftriaxone and is able to take oral medication on the third day of his hospitalisation, there is no need to continue *i.v.* ceftriaxone. *S. pneumoniae* is usually susceptible to amoxicillin but this depends on the regional resistance pattern. It should be noted that there is no need for a chest radiograph to be repeated prior to discharge in those who have made a satisfactory clinical recovery. Pneumococcal urine antigen testing is recommended for patients with moderate or high severity CAP.

A CT scan is not expected to give any further information at this point, as radiological resolution often lags behind clinical improvement from CAP.

The patient improved clinically and there is no contraindication to oral therapy. The following features indicate a response to initial empirical parenteral therapy permitting consideration of oral antibiotic substitution according to the 2009 British Thoracic Society guidelines: resolution of fever for >24 h; pulse rate <100 beats per min; resolution of tachypnoea; the patient is clinically hydrated and taking oral fluids; resolution of hypotension; absence of hypoxia; improvement in white cell count; nonbacteraemic infection; no microbiological evidence of *Legionella*, staphylococcal or Gram-negative enteric bacilli infection; and no concerns over gastrointestinal absorption.

There is no indication for a broader empiric antibiotic therapy with impenem. The combination with erythromycin offers no clinical benefit in an empiric therapy.

There is no need for bronchoscopy for inspection or to obtain bacterial samples. Even if the patient would not have improved clinically after 4 days, there should be a careful review of clinical history, examination, prescription chart and results of all available investigations. Further investigations include ordering a repeat chest radiograph, C-reactive protein and white cell count, and repeated sputum sampling before considering other tests.

Reference

Lim WS *et al.* BTS guidelines for the management of community acquired pneumonia in adults: update 2009. *Thorax* 2009; 64: Suppl. 3, iii1–iii55.

HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 57%

Question 157

A 58-year-old male hospitalised with a hip fracture for 1 week complains about shortness of breath, fever and cough with purulent sputum production for the past 2 days. He is a nonsmoker with a history of hypertension. The patient is in good clinical condition and in moderate respiratory distress. Vital signs are blood pressure 130/60 mmHg, heart rate 100 beats per min, breath rate 30 breaths per min and temperature 37.9 °C. Rales in the upright seated position and bronchial breath sounds are revealed on auscultation on the left chest posteriorly. A complete blood count shows a white blood cell count of $17\,000 \times 10^9$ cells per L with 78% mature neutrophils, haematocrit 38%, creatinine 90 $\mu mol \cdot L^{-1}$ and oxygen saturation on room air is 93%. A chest radiograph confirms left lower lobe pneumonia. The patient has not been on any antimicrobial therapy until now.
Which one of the following is the appropriate empirical antibiotic therapy for this patient?

a. Third generation cephalosporin plus azithromycin
b. Ertapenem as monotherapy
c. β-lactam (cefotaxime, ceftriaxone, or ampicillin-sulbactam) plus a fluoroquinolone
d. Anti-pseudomonal β-lactam (cefepime, piperacillin/tazobactam) plus either ciprofloxacin or levofloxacin
e. Aminopenicillin plus β-lactamase inhibitor plus aminoglycoside

Correct answer

d. Anti-pseudomonal β-lactam (cefepime, piperacillin/tazobactam) plus either ciprofloxacin or levofloxacin

The patient suffers from hospital-acquired pneumonia (HAP, acquired within 7 days of a hospital stay). The incidence of HAP is 0.5–2.0% among all hospitalised patients and it is the second most common nosocomial infection, but the first in terms of mortality (30–70%). The outcome of HAP clearly depends on the adequacy of initial antimicrobial treatment. Initial antimicrobial treatment almost always has to be started empirically. Adequate initial empirical antimicrobial treatment crucially depends on the identification of essential risk factors for distinct pathogens. Three fundamental determinants for particular pathogen spectrums have been recognised.

1. Pneumonia of the spontaneously breathing or the ventilated patient. The available data indicates that in spontaneously breathing patients potentially drug-resistant microorganisms play a minor role.
2. Time course of development of pneumonia (early *versus* late). The expected pathogens in early-onset pneumonia (onset ≤4 days after hospital admission) include *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Haemophilus influenzae* and non-drug-resistant Gram-negative bacteria (GNEB). In late-onset pneumonia (onset >4 days after hospital admission) principal pathogens include methicillin-resistant *Staphylococcus aureus* (MRSA), drug-resistant GNEB, *Pseudomonas aeruginosa*, *Acinetobacter baumannii* and other potentially drug-resistant microorganisms.
3. Presence of defined risk factors. These include age, structural lung disease, previous antimicrobial treatment, prior tracheobronchial colonisation (mainly as a result of comorbidity and previous antimicrobial treatment).

In patients with late-onset HAP (as the patient in this question) or at risk for *P. aeruginosa*, initial treatment should preferably be a combination treatment of anti-pseudomonas β-lactams or carbapenems and an anti-pseudomonal quinolone. In the absence of other alternatives, increased resistance rates to quinolones and concerns about the adverse effects of increased quinolone use, aminogylcosides should still be considered as an additional suitable choice.

References

Blasi F. Hospital-acquired pneumonia. *In*: Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 203–206.

Torres A, *et al.* Defining, treating and preventing hospital acquired pneumonia: European perspective. *Intensive Care Med* 2009; 35: 9–29.

HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 55%

Question 158

Which of the following statement(s) is/are true regarding pleural effusion?

a. Hepatic hydrothorax is more often located in the left hemithorax than in the right.
b. In a chylothorax, the chylous fluid typically has a low triglyceride and a high cholesterol concentration.
c. Eosinophils are compatible with previous blood or air entering the pleural space.
d. A ratio of lymphocytes/polymorphonuclear cells of >0.3 makes tuberculous pleurisy unlikely.

Correct answer

c. Eosinophils are compatible with previous blood or air entering the pleural space.

Hepatic hydrothorax is most commonly located on the right side. Chylous fluid contains high concentrations of triglycerides. Eosinophilic pleural effusions, defined as ≥10% eosinophils, may be caused by many conditions. Eosinophilic pleural effusion occurs most commonly with the presence of blood or air in the pleural space, infections and malignancy. Drug-induced pleural effusions, pleural effusions accompanying pulmonary embolism and benign asbestos pleural effusions are also common causes of eosinophilic pleural effusion. No aetiology is identified in as many as one-third of patients. Pleural effusions of tuberculous origin are mostly mononuclear predominant, with a mononuclear/polymorphonuclear cell ratio of >0.75 in almost 90% of cases.

References

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Garcia-Pachon E, *et al.* Urinothorax: a new approach. *Curr Opin Pulm Med* 2006; 12: 259–263.

Krenke R, *et al.* Incidence and aetiology of eosinophilic pleural effusion. *Eur Respir J* 2009; 35: 1111–1117.

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Light RW. Update on tuberculous pleural effusion. *Respirology* 2010; 15: 451–458.

Valdés L, *et al.* Usefulness of triglyceride levels in pleural fluid. *Lung* 2010; 188: 483–489.

HERMES Syllabus link: 20 Pleural diseases
Angoff rating: 60%

Question 159

A 62-year-old male presents to the emergency department with acute shortness of breath and chest pressure. He was discharged from the hospital 5 days ago after a haemorrhagic stroke. His past medical history includes hypertension, obesity and obstructive sleep apnoea. On physical examination, the patient's heart rate is 98 beats per min, blood pressure is 110/70 mmHg, respiratory rate is 24 breaths per min and S_{pO_2} is 86% on room air. Laboratory analyses, including a complete blood cell count, basic metabolic panel, cardiac enzymes and coagulation studies are normal. An ECG shows sinus tachycardia with an incomplete right bundle branch block and nonspecific T-wave abnormalities. Echocardiography reveals an estimated pulmonary artery pressure of 60 mmHg, tricuspid regurgitation and right atrial and ventricular enlargement. A diagnosis of pulmonary embolism (PE) is made, based on CT pulmonary angiogram of the chest, which reveals multiple thrombi extending into the lobar and segmental branches of the right pulmonary artery. In addition the CT scan reveals thrombi in the pelvic veins.
Which of the following is the best management option for this patient?

a. Surgical pulmonary embolectomy
b. Thrombolysis with recombinant tissue plasminogen activator (rtPA)
c. Anticoagulant treatment with low molecular weight heparin (LMWH) or fondaparinux
d. Inferior vena cava (IVC) filter insertion
e. Compression stocking

Correct answer

d. Inferior vena cava (IVC) filter insertion

PE is a relatively common condition that affects all age groups and is potentially lethal. Early diagnosis is crucial, since immediate treatment is highly effective. An important issue is to assess the severity of the suspected or confirmed PE. PE can be stratified into several levels of risk of early death, based on the presence of risk markers. Immediate bedside clinical assessment for the presence or absence of clinical markers such as shock or hypotension allows stratification into high-risk and non-high-risk PE. This classification helps in the choice of the initial management. This patient, according to his vital signs, must be classified in the non-high-risk group of suspected PE.

Several therapeutic strategies are available for the treatment of PE, with anticoagulants the main therapy for acute PE. The main objectives of therapy in the treatment of PE are to prevent thrombus extension and recurrences of venous thromboembolism.

Thrombolytic therapy should be used in patients with high-risk PE presenting with cardiogenic shock and/or persistent arterial hypotension. Surgical pulmonary embolectomy is a recommended therapeutic alternative in patients with high-risk PE in whom thrombolysis is absolutely contraindicated or has failed. Routine use of thrombolysis or surgical embolectomy in non-high-risk PE patients is not recommended.

This patient with non-high-risk PE and an absolute contraindication to anticoagulant therapy (haemorrhagic stroke) must be treated with IVC filter insertion. IVC filter is indicated only in patients with acute venous thromboembolism who have an absolute contraindication to anticoagulant therapy (*e.g.* recent surgery, haemorrhagic stroke, significant active or recent bleeding) and in those who have objectively documented recurrent venous thromboembolism despite adequate anticoagulant therapy.

Use of LMWH or fondaparinux is the recommended form of initial treatment for most patients with non-high-risk PE, in the absence of contraindication to anticoagulant therapy.

References

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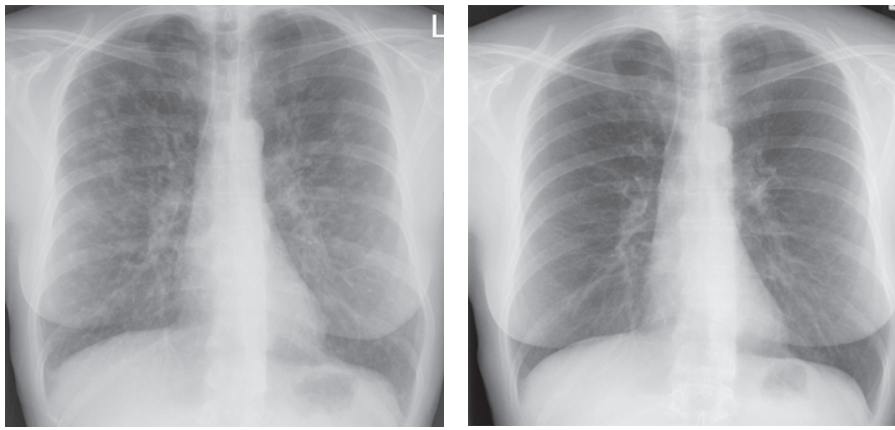
Torbicki A, *et al*. Guidelines on the diagnosis and management of acute pulmonary embolism: the Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC). *Eur Heart J* 2008; 29: 2276–2315.

HERMES Syllabus link: 14 Pulmonary vascular diseases
Angoff rating: 53%

Question 160

A 44-year-old female smoking patient works in a pet shop. In her leisure time, she sculpts stones but despite suffering from cough and dyspnoea on exertion, she never wears a particulate filter. Her lung function currently shows a FEV1/inspiratory vital capacity (IVC) ratio of 68% and a TLC of 85% pred. *T*LCO is 65% predicted. Her allergy test is positive for dust mites, and for cat and horse epithelial allergens. Bronchoalveolar lavage (BAL) fluid contains 180×10^6 cells per L, with 8% lymphocytes, 8% neutrophils and 84% macrophages. Transbronchial biopsy was not representative. Which one of the following interventions may have caused the clinical improvement and change in the radiograph?



Left: radiograph before intervention; right: radiograph after intervention.

a. Smoking cessation
b. Azathioprine
c. Infliximab
d. Pirfenidone
e. Avoidance of dust exposure

Correct answer

a. Smoking cessation.

The patient suffered from respiratory bronchiolitis-associated interstitial lung disease (RBILD), a disease that occurs almost exclusively in heavy smokers and often disappears after smoking cessation. In this patient, the patchy pulmonary infiltrates promptly disappeared after she quit smoking. The pulmonary infiltrates correspond to accumulations of pigmented macrophages and mucus in alveolar spaces. Pulmonary function tests typically reveal a mild combined obstructive and restrictive pattern with a mild-to-moderate reduced T_{LCO}. BAL cytology is characterised by an increased number of macrophages (brown pigmented) and a paucity of other inflammatory cells.

Azathioprine, infliximab and pirfenidone are not used to treat RBILD, the disease usually improves after smoking cessation, and additionally corticosteroids may hasten its regression. Silicosis caused by stone sculpting may present similarly in chest radiography, but the fluffy nodular infiltrates would not disappear after avoidance of dust exposure or any other measures. Working in a pet shop, the patient may be affected by hypersensitivity pneumonitis that could look similar in chest radiography and might improve after a change of work place. The BAL cytology in hypersensitivity pneumonitis would be expected to consist of more lymphocytes, neutrophils, eosinophils and mast cells.

Lymphocytosis in the BAL fluid would have pointed to sarcoidosis or hypersensitivity pneumonitis. In the case vignette, lymphocytes in BAL were not elevated. Smoking would rather be protective for hypersensitivity pneumonitis, although the disease has been described in a few smokers.

The case vignette and radiograph are not compatible with idiopathic pulmonary fibrosis, thus pirfenidone is not indicated. Infliximab has been shown to be effective in selected cases of sarcoidosis.

References

Baughman RP, *et al.* Infliximab therapy in patients with chronic sarcoidosis and pulmonary involvement. *Am J Respir Crit Care Med* 2006; 174: 795–802.

Wells AU, *et al.* Challenges in pulmonary fibrosis. 4: smoking-induced diffuse interstitial lung diseases. *Thorax* 2007; 62: 904–910.

HERMES Syllabus link: 10 Interstitial lung disease
Angoff rating: 53%

Question 161

A 36-year-old woman presents with shaking chills, right back pain and dysuria. On physical examination, she has right costovertebral angle tenderness and appears flushed. Her heart rate is 115 beats per min and blood pressure is 80/35 mmHg. She is admitted to the intensive care unit for further treatment.
Which of the following haemodynamic profiles is consistent with her condition?

	Cardiac output $L \cdot min^{-1}$	Systemic vascular resistance $dyn \cdot s \cdot cm^{-5}$	Systolic/diastolic pulmonary artery pressure mmHg	Pulmonary artery wedge pressure mmHg	Mixed venous oxygen saturation %
a.	7.8	500	25/7	6	78
b.	3.7	1800	35/24	22	60
c.	4.2	1700	45/30	7	65
d.	3.9	1750	24/3	3	55
e.	7.0	1200	35/12	8	75

Correct answer

	Cardiac output L·min^{-1}	Systemic vascular resistance dyn·s·cm^{-5}	Systolic/ diastolic pulmonary artery pressure mmHg	Pulmonary artery wedge pressure mmHg	Mixed venous oxygen saturation %
a.	**7.8**	**500**	**25/7**	**6**	**78**

The patient presents signs of an infection, probably pyelonephritis, and she is in septic shock. Infection is accompanied by peripheral vasodilatation (patient appears flushed) leading to a decrease of systemic vascular resistance (SVR). The normal range for SVR is 1000–1500 dyn·s·cm^{-5}. As a reaction to peripheral vasodilatation and reduction of the SVR, cardiac output increases and arterial pressure drops. The high–normal mixed venous oxygen saturation (normal range 70–80%) is consistent with a slightly elevated cardiac output (7.8 L·min^{-1}). Both are signs of a hyperdynamic phase of an infection.
All other answers show a high or normal SVR and are, therefore, unlikely in this case with hypotension.

Reference

Sramek BB, *et al*. Systemic Hemodynamics and Hemodynamic Management. Collierville, Instant Publisher, 2002.

HERMES Syllabus link: 4 Other diagnostic procedures, 18 Respiratory failure, 27 Associated specialties
Angoff rating: 42%

Question 162

A 25-year-old, previously healthy woman is referred to the emergency department of your hospital because of shortness of breath, fever and chills. She reports that she has had flu-like symptoms and fever of 39.9ºC in the previous week. After 3 days, she felt better and the fever diminished. Today, she suddenly felt worse again, and had high fever, chills and shortness of breath. On physical examination she looks ill but is well oriented. Her respiratory rate is 32 breaths per min, heart rate 110 beats per min and blood pressure 100/55 mmHg. Auscultation reveals bronchial breath sounds and rales in the right hemithorax. Chest radiography reveals a lobar infiltrate in the left upper lobe. Her laboratory results are as follows: erythrocyte sedimentation rate 135 $mm \cdot h^{-1}$, C-reactive protein 350 $mg \cdot L^{-1}$, leukocytes 19 000 cells per µL, urea 10.0 $mmol \cdot L^{-1}$, creatinine 110 $mmol \cdot L^{-1}$, sodium 135 $mmol \cdot L^{-1}$, potassium 4.0 $mmol \cdot L^{-1}$ and Hb 112 $g \cdot L^{-1}$. Liver function tests are normal. Arterial blood gas analysis on room air shows the following: pH 7.31, P_{aCO_2} 6.1 kPa (46 mmHg), base excess –8.1 $mmol \cdot L^{-1}$ and P_{aO_2} 6.8 kPa (51 mmHg).
What is the most appropriate next action?

a. Treat her as an outpatient with empiric antibiotics if she has family support.
b. Admit her to a general ward and start empiric antibiotics.
c. Admit her to a general ward and start antibiotics according to blood culture results.
d. Admit her to the intensive care unit, and start empiric antibiotics and supplemental oxygen.
e. Admit her to the intensive care unit, and start empiric antibiotics and NIV.

Correct answer

d. Admit her to the intensive care unit, and start empiric antibiotics and supplemental oxygen.

This patient has community-acquired pneumonia, based on the presence of an acute illness with cough, new focal signs in the chest, an infiltrate in the chest radiograph and fever for >4 days. The illness is severe, according to the CURB score of 3, on the basis of blood pressure, urea and respiratory frequency. Mortality in such patients is 17%. Furthermore, the patient has acute respiratory failure with severe gas exchange impairment. This justifies admission to an intensive care unit (ICU) or intermediate care unit. The definition of acute respiratory distress syndrome (ARDS) is not fulfilled, although she has severe gas exchange impairment (P_{aO_2}/inspiratory oxygen fraction is 6.8/0.21=32.4 kPa (243 mmHg)). According to the Berlin definition, the diagnosis requires bilateral opacities on chest imaging, exclusion of cardiac failure by objective means and impaired oxygenation with a positive end-expiratory pressure >5 cmH_2O. The blood gas analysis was carried out on room air and giving supplemental oxygen is the first step before intubating the patient or putting her on NIV. As oxygen administration alone might not be sufficient, ICU admission is appropriate. Because assisted mechanical ventilation may be required at a later stage, monitoring the patient in the ICU is appropriate.

References

Task Force of the American College of Critical Care Medicine, *et al.* Guidelines for intensive care unit admission, discharge, and triage. *Crit Care Med* 1999; 27: 633–638.

The ARDS Definition Task Force. Acute respiratory distress syndrome: the Berlin definition. *JAMA* 2012; 307: 2526–2533.

Woodhead M. Pneumonia. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 199–202.

HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 65%

Question 163

A 56-year-old missionary nun returns from Vietnam. She has been in the country for 6 months travelling among local communities. She has a cough, with some blood-streaked sputum, and she reports some breathlessness. She has no fever. Chest radiography shows a pleural effusion and cavitating lesions in the mid-zone on the same side as the pleural effusion. Thoracentesis shows an exudative pleural fluid and a low glucose concentration, and a differential cell count shows that the fluid contains >10% eosinophils.
Which of the following is the most likely cause?

a. Actinomycosis
b. Tuberculosis
c. Streptococcal infection
d. Paragonimiasis
e. Lung cancer

Correct answer

d. Paragonimiasis

Paragonimiasis is caused by inflammation and fibrosis due to worms in the lung. The clinical presentation depends on the duration of infection. Although the patient may experience some malaise, fever is generally not a feature. The patient often does not feel or appear ill despite the recurrent haemoptysis. Blood eosinophilia is often absent. Generally, one or more lesions at the sites of localised encysted flukes or their burrowing tracts are recognised on chest radiography. When abnormalities are visible on chest radiograph or CT, one or more of the following may be seen: ring shadow lesions resulting from the relative lucency of the contents of the cystic cavities; or parenchymal mass lesions. The pulmonary lesions are often mistaken for tuberculosis, particularly as the two diseases are often co-endemic. The lesions of paragonimiasis generally are more peripherally located and much more common in the mid- and lower lung zones, as opposed to the predominantly apical location of tuberculous cavities. Eosinophilia is not a typical feature of streptococcal infection or tuberculosis and streptococcal disease typically causes fever. A lung cancer, in particular of the squamous cell type, may cause cavitation, but eosinophilia would not be expected.

References

Khemasuwan D, *et al.* Parasites of the air passages. *Chest* 2014; 145: 883–895.

Kuzucu A. Parasitic diseases of the respiratory tract. *Curr Opin Pulm Med* 2006; 12: 212–221.

Mabeza GF, *et al.* Pulmonary actinomycosis. *Eur Respir J* 2003; 21: 545–551.

HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 34%

Question 164

A 21-year-old man with Duchenne muscular dystrophy suffers from chronic alveolar hypoventilation. He is on 24-h NIV using a portable bilevel positive airway pressure ventilator operated in the spontaneous/timed mode. During a routine follow-up, you perform arterial blood gas analysis, which reveals an elevated P_{aCO_2}. Analysis of data stored in the ventilator memory shows that 90% of breaths are patient-triggered.
Which of the following measures would be most likely to reduce hypercapnia?

a. Supplemental oxygen
b. Increasing expiratory positive airway pressure
c. Increasing water vapour pressure (humidification)
d. Increasing inspiratory positive airway pressure
e. Reducing respiratory rate

Correct answer

d. Increasing inspiratory positive airway pressure

The cause of hypercapnia in this case of neuromuscular disease with respiratory muscle weakness is alveolar hypoventilation. In order to increase alveolar ventilation, increased ventilatory support is required, which can be achieved by an increase in inspiratory positive airway pressure. This will increase tidal volume and, hence, $\dot{V}_E$. Applying supplemental oxygen might even worsen hypercapnia by reducing the hypoxic ventilatory drive and subsequently reducing the breath rate, which is triggered by the patient in the spontaneous/timed mode. By increasing the expiratory positive airway pressure, the pressure amplitude between inspiration and expiration, and therefore the tidal volume, would decrease, so the hypercapnia would worsen. Reducing the back-up respiratory rate will have no effect as the patient is breathing at a higher rate than the selected back-up rate (90% of breaths are patient triggered). Humidification has no effect on alveolar ventilation and is therefore not an effective measure to reduce hypercapnia.

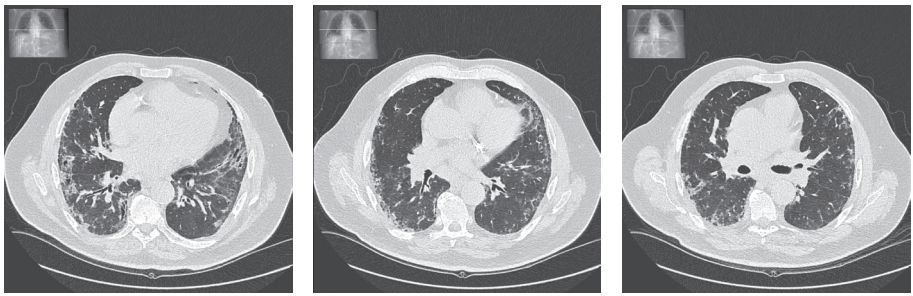
Reference

Simonds AK. NIV in acute respiratory failure. *In:* Palange P, *et al.* eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 166–170.

HERMES Syllabus link: 18 Respiratory failure, 19 Diseases of the chest wall and respiratory muscles including the diaphragm
Angoff rating: 58%

Question 165

A 52-year-old woman complains of weight loss, asthenia and dyspnoea. Examination reveals symmetrical proximal weakness, elevated muscle enzymes in serum and muscle biopsy showing inflammation. Some relevant slices of the chest CT are shown below.



Which of the following is a lung biopsy most likely to show?

a. Diffuse alveolar haemorrhage
b. Desquamative interstitial pneumonia
c. Eosinophilic pneumonia
d. Usual interstitial pneumonia
e. Nonspecific interstitial pneumonia

Correct answer

e. Nonspecific interstitial pneumonia

This patient's presentation is consistent with a diagnosis of polymyositis. Polymyositis and dermatomyositis typically show a nonspecific interstitial pneumonia pattern with lung involvement. Rarely, other patterns, like usual interstitial pneumonia (UIP), have been reported. In addition to the described clinical and laboratory findings, anti-Jo-1 antisynthetase antibodies are a typical finding.

Typical reasons for diffuse alveolar haemorrhage include vasculitis, connective tissue disease and drugs. The most common causes are granulomatosis with polyangiitis, Goodpasture syndrome, idiopathic pulmonary haemosiderosis, collagen vascular diseases and microscopic polyangiitis.

Desquamative interstitial pneumonia is typically associated with smoking and ground-glass opacities but not reticular changes on HRCT, and lacks the muscular symptoms described here.

Acute eosinophilic pneumonia (AEP) and chronic eosinophilic pneumonia (CEP) are very readily distinguished entities. AEP patients present with hypoxaemic respiratory insufficiency that develops over a few days. CEP is a progressive syndrome with cough, fever and progressive breathlessness, usually found in patients with a positive history of asthma. Both entities have bronchial lavage eosinophilia in common but do not show the muscular symptoms described here.

A UIP pattern would point to the diagnosis of idiopathic pulmonary fibrosis (IPF), which typically presents with progressive dyspnoea and cough. Typical findings on HRCT include lower lobe and subpleural predominant fibrosis and honeycombing as well as traction bronchiectasis with progressive disease. IPF is not associated with any of the muscular symptoms described here either.

References

Dalakas MC, *et al.* Polymyositis and dermatomyositis. *Lancet* 2003; 362: 971–982.

Cottin V, *et al.* Interstitial lung disease in amyopathic dermatomyositis, dermatomyositis and polymyositis. *Eur Respir J* 2003; 22: 245–250.

Raghu G, *et al.* An official ATS/ERS/JRS/ALAT statement: idiopathic pulmonary fibrosis: evidence-based guidelines for diagnosis and management. *Am J Respir Crit Care Med* 2011; 183: 788–824.

HERMES Syllabus link: 10 Interstitial lung disease, 13 Respiratory consequences of systemic/extrapulmonary disorders, 15 Occupational diseases
Angoff rating: 52%

Question 166

One of the passengers on a flight from New York to Brussels was discovered to have multidrug-resistant (MDR) tuberculosis after she arrived in Brussels. 2 weeks later you are consulted by one of the passengers who had been on the same flight and had been informed that she should seek medical advice. That passenger is otherwise healthy, and recent HIV and tuberculin tests were negative.
Which one of the following management options would be most appropriate?

a. Immediate chest radiograph
b. Tuberculin test or interferon-γ release assay (IGRA) in 6 weeks
c. Prophylactic chemotherapy similar to that prescribed to the patient in the USA
d. Treatment only if the tuberculin test or IGRA is positive
e. Chest radiograph in 6 weeks

Correct answer

b. Tuberculin test or interferon-γ release assay (IGRA) in 6 weeks

2 weeks after contact, a chest radiograph would be unhelpful as the infection at contact would not have manifested yet. A positive tuberculin test or IGRA may indicate latent tuberculosis (TB) infection and a chest radiograph should only be performed after a positive result is obtained. Preventive anti-TB chemotherapy is not indicated for infection with MDR-TB because there is no evidence that it will be effective and because only a small proportion of infected contacts will develop TB. Contacts who test positively should be actively followed up for >2 years. Whether patients at elevated risk for developing active TB (such as HIV-infected patients) should receive preventive treatment for latent MDR-TB infection is currently unknown.

References

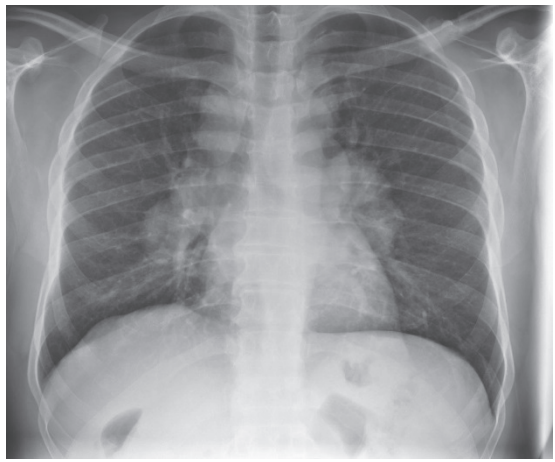
National Institute for Health and Clinical Excellence. Tuberculosis. Clinical diagnosis and management of tuberculosis, and measures for its prevention and control. www.nice.org.uk/nicemedia/live/13422/53642/53642.pdf

Erkens CG, *et al*. Tuberculosis contact investigation in low prevalence coutries: a European consensus. *Eur Respir J* 2010; 36: 925–949.

HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 59%

Question 167

A 32-year-old woman presents with a 1-week history of painful, tender lumps overlying the pretibial regions, low-grade fever and polyarthritis primarily involving her ankles. The chest radiograph is shown below.



Bronchoscopy with bronchoalveolar lavage and transbronchial lung biopsies are performed. The lavage fluid contains 30% lymphocytes; the remaining cells are mostly alveolar macrophages. Special stains for fungi and acid-fast bacilli are negative.
Which one of the following statements about this disease is incorrect?

a. This patient can expect a spontaneous remission.
b. Serum angiotensin-converting enzyme is elevated in one third or more of patients.
c. Immunological analysis of the skin lesions will show a similar pattern of lymphocytes and macrophages.
d. A symmetric enlargement of the mediastinal lymph glands, as in this case, is quite typical.
e. Honeycomb cysts, bullae or traction bronchiectasis on CT reflect irreversible fibrosis and poor response to therapy.

Correct answer

c. Immunological analysis of the skin lesions will show a similar pattern of lymphocytes and macrophages.

This patient has a clinical presentation highly suggestive of acute sarcoidosis with Löfgren's syndrome. Typically, this occurs in women and includes erythema nodosum, bilateral lymphadenopathy, fever and migratory polyarthritis. The prognosis is good and spontaneous remission occurs in nearly two thirds of the patients. Adverse prognostic factors include lupus pernio, chronic uveitis, age at onset >40 years, chronic hypercalcaemia, nephrocalcinosis, African ethnic origin, progressive pulmonary sarcoidosis, nasal mucosal involvement, cystic bone lesions, and neural or cardiac sarcoidosis. Bronchoalveolar lavage with an elevated lymphocyte count and an increased CD4/CD8 ratio of lymphocyte subpopulations may support the diagnosis. The classical Löfgren's syndrome does not require biopsy proof. If biopsy is performed, it may show noncaseating granulomas. Elevated serum angiotensin-converting enzyme and calcium levels are consistent with the diagnosis of sarcoidosis. Chest radiography is part of the baseline assessment. Although CT scanning provides much greater detail of mediastinal and parenchymal abnormalities, it is not an essential baseline examination in typical cases of Löfgren's syndrome. Chest CT is indicated if the diagnosis is unclear or to detect complications. If the CT scan shows signs of advanced-stage sarcoidosis, the response to therapy is poor.

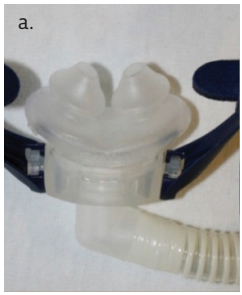
Reference

Costabel U. Sarcoidosis. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 382–385.

HERMES Syllabus link: 10 Interstitial lung disease
Angoff rating: 61%

Question 168

A 67-year-old smoker with COPD suffers from an acute exacerbation with hypercapnic respiratory failure. There is no bed available in the intensive care unit. Therefore, you decide to treat the patient in the general ward. A nurse prepares a bilevel positive airway pressure home ventilator.
Which of the tubes/masks shown below is most appropriate?



Correct answer

NIV is an effective treatment option for acute hypercapnic respiratory failure due to an exacerbation in COPD patients. Apart from ventilators used in intensive care, simple and portable ventilators used in home care and sleep medicine are increasingly used. Home ventilators are typically turbine-driven bilevel positive airway pressure devices that apply a constant positive airway pressure at an expiratory level with superimposed cyclic increases (inspiratory pressure) to support inspiration. In this open circuit, carbon dioxide is purged through a leak (multiple holes or slits) in the mask where the exhaled air is washed out by the high flow generated by the ventilator. A typical full-face mask to be used with a home ventilator is shown in answer b (correct answer). Answer a shows a nasal mask that can also be used with a home ventilator but this is not suitable for treatment of acute respiratory failure because it does not prevent major mouth leaks in dyspnoeic patients breathing through their mouth. Answers c and d show masks and tubes with valves suitable for use with more complex ventilators that work with a partially closed circuit (as used in intensive care units). The valves are closed during inspiration and opened during expiration to release the expired air. Answer e shows a mask without leak valves, which is therefore not suitable for home ventilators that work with an open circuit.

References

Dwarakanath A, *et al.* Noninvasive ventilation in the management of acute hypercapnic respiratory failure. *Breathe* 2013; 9: 339–348.

Simonds AK. NIV in acute respiratory failure. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 166–170.

HERMES Syllabus link: 18 Respiratory failure, 22 Sleep and control of breathing disorders
Angoff rating: 60%

Question 169

Which one of the following statements about aspirin-exacerbated respiratory disease is correct?

a. It is more prevalent in men than women.
b. It is generally atopic.
c. It is more often severe than other forms of asthma.
d. It is rarely associated with rhinosinusitis.
e. It disappears in most patients with advancing age.

Correct answer

c. It is more often severe than other forms of asthma.

Aspirin-exacerbated respiratory disease (AERD) is an aggressive mucosal non-immunoallergic inflammatory disease combined with precipitation of asthma and rhinitis attacks that occurs after ingestion of aspirin and most nonsteroidal anti-inflammatory drugs (NSAIDs). If clinical diagnosis is uncertain, the diagnosis can be confirmed by an aspirin challenge in a specialised centre.

Up to 28% of adults with asthma suffer from exacerbations in response to aspirin and other NSAIDs. AERD is more common in severe asthma. Women are affected 2.5 times more often than men. Symptoms may include vasomotor rhinitis and profuse rhinorrhoea, chronic nasal congestion evolves, and physical examination often reveals nasal polyps. Once aspirin or NSAID hypersensitivity develops, it is present for life if desensitisation is not performed. Patients with AERD should avoid aspirin and other NSAIDs that inhibit cyclooxygenase (COX)-1. If required, patients may use a COX-2 inhibitor (celecoxib) or paracetamol. Desensitisation may improve symptoms and quality of life, and reduce formation of nasal polyps.

References

Szczeklik A, *et al.* Clinical features and diagnosis of aspirin induced asthma. *Thorax* 2000; 55: Suppl. 2, S42–S44.

Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention. www.ginasthma.org/local/uploads/files/GINA_Report_2015_May19.pdf Date last updated: May 19, 2015.

HERMES Syllabus link: 6 Airway diseases, 11 Drug and radiation induced lung diseases
Angoff rating: 64%

Question 170

A 64-year-old woman undergoes diuretic therapy for severe congestive heart failure complicated by a right-sided pleural effusion. 3 weeks later, her symptoms are moderately improved and her weight has decreased by 4.5 kg, but the effusion persists. She denies have experienced fever, cough, chest pain or leg swelling. Physical examination shows an S3 and a grade 3/6 pansystolic murmur. Which is the most likely pleural fluid profile of this patient?

	Pleural fluid/serum protein ratio	Pleural fluid/serum LDH ratio	Pleural fluid LDH $U \cdot L^{-1}$	Pleural fluid/serum cholesterol ratio	Amylase $U \cdot L^{-1}$	pH	Mesothelial cells %
a.	0.9	4.0	800	0.9	80	7.3	3
b.	0.7	3.0	900	0.7	1200	7.4	10
c.	0.7	4.1	890	0.7	1200	6.9	8
d.	0.6	0.5	150	0.2	80	7.4	6
e.	0.4	0.3	80	0.2	200	7.2	3

LDH: lactate dehydrogenase.

Correct answer

	Pleural fluid/serum protein ratio	Pleural fluid/ serum LDH ratio	Pleural fluid LDH $U \cdot L^{-1}$	Pleural fluid/serum cholesterol ratio	Amylase $U \cdot L^{-1}$	pH	Mesothelial cells %
d.	**0.6**	**0.5**	**150**	**0.2**	**80**	**7.4**	**6**

The patient's history and physical examination are compatible with pleural effusion due to congestive heart failure. Successful treatment of heart failure results in the reabsorption of the effusions over a period of days to weeks. If water is reabsorbed faster than proteins, the protein concentration will increase over time and the effusion may develop the characteristics of an exudate. However, the LDH concentration will usually remain below 240 $IU \cdot L^{-1}$. Furthermore a pleural fluid/serum cholesterol ratio <0.3 is suggestive of a transudate. The pH of a transudate is commonly >7.30.

References

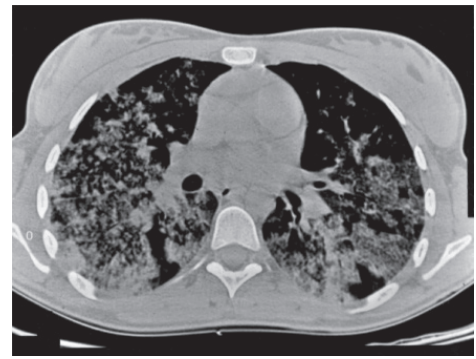
Kinasewitz GT. Transudative effusions. *Eur Respir J* 1997; 10: 714–718.

Light RW, *et al.* Pleural effusion. *N Engl J Med* 2002; 346: 1971–1977.

HERMES Syllabus link: 20 Pleural diseases
Angoff rating: 53%

Question 171

A 50-year-old man is admitted for fever, mild haemoptysis and bilateral lung infiltrates. He is a smoker (100 pack-years), consumes alcohol daily (~100 g·day^{-1}) and was an employee at a gasoline station. His past medical history includes recurrent gout attacks and arterial hypertension. 2 weeks ago, he suffered from arthritis of his right knee, started to feel weak and experienced a marked loss of energy. 1 week ago, he began to cough up small amounts of blood-tinged sputum and was markedly short of breath with mild exertion. On admission, his temperature is 37.8ºC, blood pressure is 190/90 mmHg and heart rate is 100 beats per min. He is dyspnoeic while speaking, his respiratory rate is 32 breaths per min and his oxygen saturation is 80% on room air. His chest radiograph and CT image are shown below.



Laboratory results show a serum C-reactive protein concentration of 320 mg·L^{-1}, Hb 102 g·L^{-1}, creatinine 145 mmol·L^{-1} and normal liver enzymes. Urine analysis reveals large amounts of deformed erythrocytes. Anti-glomerular basement membrane antibodies are moderately elevated (twice the normal value). Bronchoscopy confirms diffuse alveolar haemorrhage with no infection.
What is the most appropriate management of this case?

a. Immediately obtain a thoracoscopic lung biopsy to confirm the diagnosis and subsequently start high-dose methylprednisolone.
b. Start high-dose methylprednisolone and obtain transbronchial biopsies to confirm the diagnosis.
c. Start high-dose methylprednisolone, cyclophosphamide and plasmapheresis, and obtain a thoracoscopic lung biopsy.
d. Start high-dose methylprednisolone, cyclophosphamide and plasmapheresis, and arrange for a renal biopsy.
e. Draw more blood to rule out elevation of anti-neutrophil cytoplasmic antibody before starting high-dose methylprednisolone and cyclophosphamide.

Correct answer

d. Start high-dose methylprednisolone, cyclophosphamide and plasmapheresis, and arrange for a renal biopsy.

Anti-glomerular basement membrane (GBM) antibody disease is a rare autoimmune disorder in which circulating antibodies are directed against an antigen normally present in the GBM and alveolar basement membrane. The combination of glomerulonephritis and pulmonary haemorrhage is commonly referred to as Goodpasture syndrome. Pulmonary and/or renal manifestations can be encountered in various conditions, such as anti-neutrophilic cytoplasmic antibody (ANCA)-positive vasculitis and other autoimmune disorders. Anti-GBM antibodies in the patient's serum or tissues are pathognomonic for the diagnosis of Goodpasture disease.

Most patients present with features of systemic illness and either acute nephritis or pulmonary involvement; a subset may have all three findings. Symptoms of systemic illness include low-grade fever, malaise, headache, anorexia, nausea, vomiting, weight loss and fatigue. Symptoms of renal involvement include haematuria, oliguria and oedema. Symptoms of pulmonary involvement include shortness of breath, cough and expectoration of material that ranges from blood-streaked sputum to massive haemoptysis. Gross or microscopic haematuria may be present. Urinalysis may reveal nephritic urinary sediment with dysmorphic red blood cells and red blood cell casts. Proteinuria is usually present but protein levels are not in the nephrotic range.

Approximately 30% of patients with Goodpasture syndrome are ANCA positive at some time during the illness. The detection of ANCA is clinically relevant in anti-GBM disease because patients with this disease are more likely to respond to therapy. Besides having prognostic value in anti-GBM disease, ANCA is an important diagnostic marker in the ANCA associated small-vessel vasculitides, such as granulomatosis with polyangiitis, microscopic polyangiitis, eosinophilic granulomatosis with angiitis (Churg–Strauss syndrome) and some forms of drug-induced vasculitis (*e.g.* thiouracil). These conditions are included in the differential diagnosis of anti-GBM disease.

Diffuse alveolar haemorrhage represents a medical emergency. In the appropriate clinical setting (*i.e.* alveolar haemorrhage and urinary findings suggestive of an acute glomerulonephritis), the detection of circulating anti-GBM antibodies allows the clinician to make a firm diagnosis of anti-GBM disease. This obviates lung or kidney biopsy. When the diagnosis remains in doubt, renal biopsy is the best method for detecting anti-GBM antibodies in tissues. Patients in whom the diagnosis of diffuse alveolar haemorrhage remains uncertain should undergo diagnostic bronchoscopy, which also can rule out or confirm an underlying pulmonary infection.

The treatment for Goodpasture syndrome includes plasmapheresis in combination with intense immunosuppression consisting of corticosteroids and cyclophosphamide or azathioprine. When a patient presents in a life-threatening situation secondary to pulmonary haemorrhage, appropriate therapy must be initiated if the diagnosis appears very likely even though confirmation is not available immediately.

References

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Frankel SK, *et al.* Update in the diagnosis and management of pulmonary vasculitis. *Chest* 2006; 129: 452–465.

Salama AD, *et al.* Goodpasture's disease. *Lancet* 2001; 358: 917–920.

HERMES Syllabus link: 7 Respiratory infections, 13 Respiratory consequences of systemic/extrapulmonary disorders, 14 Pulmonary vascular diseases, 27 Associated specialties
Angoff rating: 50%

Question 172

A 35-year-old female patient, suffering from asthma since childhood, receives budesonide/formoterol (200/6 μg) combination treatment (two inhalations twice daily), and montelukast once daily. The patient has no nocturnal symptoms, nor does she report any limitation of activities. However, she uses salbutamol for relief three times weekly, her FEV_1 is 70% predicted and she has received three courses of oral steroids in the past year. Her IgE levels have been 150–250 $kU \cdot L^{-1}$ over the course of the past 3 months.
Which one of the following statements is correct regarding her management?

a. No change in treatment is justified.
b. Anti-IgE treatment should be instituted.
c. Triggering factors should be investigated and a step up of treatment is required.
d. The dose of the combination given to the patient is very high and must be lowered.
e. Long-term low-dose oral corticosteroids are recommended.

Correct answer

c. Triggering factors should be investigated and a step up of treatment is required.

This patient has uncontrolled asthma based on oral steroid courses and salbutamol use more than twice weekly, even if she does not report symptoms or limitations. Therefore a step up in treatment is required. The patient has moderately elevated IgE levels. Triggering factors and her allergic background should be examined. The Global Initiative for Asthma (GINA) strategy states that anti-IgE is a treatment option limited to patients with elevated serum levels of IgE (*i.e.* >100 $kU \cdot L^{-1}$) and that for allergic patients, with an elevated IgE, not controlled on high-dose inhaled glucocorticosteroids and a long acting β_2-agonist and who continue to have exacerbations, a trial of omalizumab can be considered. Therefore the inhaled steroid should be increased to a high dose first.

The patient's budesonide dose is moderate (800 μg per day). According to the GINA strategy, high doses of budesonide for adults are considered to be more than 800 μg per day. The patient should be treated according to step four of the GINA treatment steps. However, before stepping up the treatment to step four it is advisable to increase inhaled corticosteroids to a high dose and try sustained-release theophylline.

References

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HERMES Syllabus links: 6 Airway diseases
Angoff rating: 58%

Question 173

A 52-year-old man, who is a teacher and a nonsmoker, complains of a dry cough that he has had for the past 8 months. Within the past 3 months, he has felt some shortness of breath. He has been previously healthy and does not take any medication. Detailed history does not suggest any occupational or environmental risk factors. Fine crackles (velcro) can be heard over both lung. There is no clubbing. CT of the lung shows an extensive, bilateral ground-glass pattern together with reticular opacities, especially in the periphery. There is no honeycombing or lymphadenopathy. Which of the following is the most likely diagnosis?

a. Idiopathic pulmonary fibrosis (usual interstitial pneumonia type)
b. Nonspecific interstitial pneumonitis
c. Cryptogenic organising pneumonia
d. Respiratory bronchiolitis-associated interstitial lung disease
e. Sarcoidosis

Correct answer

b. Nonspecific interstitial pneumonitis

The described case shows the typical presentation of nonspecific interstitial pneumonitis (NSIP). Men and women in their 50s and 60s are affected equally, and show a slow progression of cough and dyspnoea. Careful assessment of the patient's history fails to identify any cause of his interstitial lung disease, such as occupational or environmental exposures, drugs, or autoimmune disease.

While idiopathic pulmonary fibrosis of the usual interstitial pneumonia (UIP) type typically presents with progressive dyspnoea and cough, the UIP pattern on CT includes lower lobe and subpleural predominant fibrosis with patchy involvement of the lung parenchyma. Areas of little or no involvement typically alternate with parenchyma showing scarring and honeycombing. Traction bronchiectasis can be seen with progressive disease. UIP shows less ground-glass opacity than reticulation. Although we cannot completely exclude an early UIP, it is less likely than NSIP.

Cryptogenic organising pneumonia presents with patchy bilateral consolidation, sometimes associated with perifocal ground-glass opacities. The consolidations typically vary over time; disappear in one location and emerge in others.

Respiratory bronchiolitis-associated interstitial lung disease (RB-ILD) is a typical disease of smokers with an average exposure of >30 pack-years. Radiologically, RB-ILD features bronchial wall thickening, centrilobular nodules, patchy ground-glass opacities and areas with low attenuation levels due to air trapping.

Pulmonary sarcoidosis typically presents with cough, dyspnoea and chest pain. However, crackles are not commonly heard. Often, patients also complain of fatigue, malaise, fever and weight loss. While radiological staging of sarcoidosis is assessed with a conventional chest radiograph, HRCT often shows a variety of intrathoracic abnormalities. These include hilar and mediastinal lymphadenopathy, and thickening and nodules along the bronchovascular bundles. Parenchymal masses or nodular consolidation, ground-glass opacities and fibrosis can also be found.

References

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HERMES Syllabus link: 10 Interstitial lung disease, 13 Respiratory consequences of systemic/extrapulmonary disorders, 15 Occupational diseases
Angoff rating: 57%

Question 174

A 62-year-old woman with COPD is admitted to the hospital because of fever, fatigue and severe dyspnoea. Her nutritional status is normal but she is cyanotic and breathing at 35 breaths per min. The clinical examination and the chest radiograph disclose a consolidation of the left lower lobe. Because respiratory acidosis is worsening, she is admitted to the intensive care unit and intubated. She is treated with an intravenous antibiotic, prednisone (50 mg per day) and inhaled bronchodilators. The lung consolidation slowly resolves after 14 days but several attempts to resume spontaneous breathing fail because of tachypnoea, unbearable dyspnoea and elevation of P_{aCO_2}.

At this point, which is the most appropriate test to identify the cause of weaning failure?

a. Body composition by bioimpedance analysis
b. Hypoxic response test
c. Hypercapnic response test
d. Electrophysiological studies of peripheral nerves and muscles
e. Muscle biopsy

Correct answer

d. Electrophysiological studies of peripheral nerves and muscles

Weaning from mechanical ventilation is one of the main challenges in intensive care units. Weaning failure is frequently associated with severe underlying disease and less-than-optimal improvement in the underlying pulmonary condition. The weaning failure of this patient is caused by neuromuscular weakness manifesting as tachypnoea and hypercapnia during the weaning trial. This patient most likely suffers from critical-illness neuromyopathy; mechanical ventilation, steroid treatment, neuromuscular blocking agents and aminoglycoside antibiotics are predisposing factors for critical-illness myopathy. An electroneuromyogram is the most appropriate diagnostic test to identify critical-illness neuromyopathy.
Hypoxic and hypercapnic response tests are used to assess ventilatory control. Muscle biopsy is too invasive for this patient but would probably prove nonspecific changes of the myocytes compatible with critical-illness myopathy.

References

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HERMES Syllabus link: 18 Respiratory failure, 27 Associated specialties
Angoff rating: 54%

Question 175

Regarding determination of lung volumes, which of the following statements is/are correct?

a. Functional residual capacity measured by the closed-circuit helium dilution method includes the volume of gas within lung bullae.
b. The accuracy of the gas dilution techniques in measuring lung volumes is dependent on beginning and ending the test at the same volume.
c. Plethysmographic techniques for determining lung volumes measure the communicating and noncommunicating intrathoracic gas volumes.
d. Plethysmographic determination of lung volumes is accurate regardless of starting volume.

Correct answers

b. The accuracy of the gas dilution techniques in measuring lung volumes is dependent on beginning and ending the test at the same volume.
c. Plethysmographic techniques for determining lung volumes measure the communicating and noncommunicating intrathoracic gas volumes.

The helium dilution method is a way of measuring the functional residual capacity (FRC) of the lungs (the volume left in the lungs after normal expiration). With this technique, a closed-circuit system is used where a spirometer is filled with a mixture of helium and oxygen. The amount of helium in the spirometer is known at the beginning of the test (concentration × volume = amount). The patient is then asked to breathe in the mixture starting at FRC, *i.e.* after a normal expiration. The helium concentration in the spirometer is measured. The helium spreads into the lungs of the patient and is diluted until a plateau concentration is reached. Because helium is not absorbed by the lungs to a relevant degree there is no loss of this inert gas, and the amount of helium in the lungs and in the spirometer remains constant during the test. From the known volume of the spirometer, the initial helium concentration and the change in the helium concentration during the test, the FRC can be calculated. If the patient is initially connected to the spirometer at a different lung volume (*e.g.* TLC), this will be the measured volume.
The helium dilution method measures FRC excluding the volumes of gas not properly participating in ventilation like lung areas with trapped air (bullae) or extrapulmonary air (pneumothorax). In contrast, body plethysmography also measures the noncommunicating intrathoracic gas volumes. The volume in the lungs measured after a normal expiration is called the intrathoracic gas volume (ITGV). In healthy subjects, ITGV = FRC.
Plethysmographic determination of lung volumes is started from ITGV (after a normal expiration). The patient should be asked to breathe in and out normally. There should be no drift in the end-expiratory lung volume, or ITGV would be measured inaccurately.

References

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HERMES Syllabus link: 3 Pulmonary function testing
Angoff rating: 57%

Question 176

Which of the following statements is/are correct concerning asbestos-related malignancies?

a. Asbestos exposure is associated with an increased incidence primarily of small cell lung cancer.
b. Asbestos exposure in cigarette smokers multiplies the risk of lung cancer.
c. The risk for developing malignant mesothelioma is independent of the history of cigarette smoking.
d. Latency between asbestos exposure and lung cancer peaks at 10 years.

Correct answers

b. Asbestos exposure in cigarette smokers multiplies the risk of lung cancer.
c. The risk for developing malignant mesothelioma is independent of the history of cigarette smoking.

The most common type of lung cancer in cases of asbestos exposure is nonsmall cell lung cancer. Exposure to both cigarette smoking and asbestos increases the risk of lung cancer significantly, with a synergistic effect between the two. In contrast, the risk of mesothelioma is related only to asbestos exposure, independent of cigarette smoking. The latency period between the initial asbestos exposure and lung malignancy is quite long, typically between 15 and 35 years.

References

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HERMES Syllabus link: 9 Thoracic tumours, 15 Occupational diseases, 27 Associated specialties
Angoff rating: 62%

Question 177

During an influenza outbreak, a 35-year-old obese female, who has a history of asthma, is admitted to hospital with worsening dyspnoea associated with a cough, wheeze and phlegm. The patient is treated for a virus-induced asthma exacerbation with intravenous corticosteroids and nebulised bronchodilators. She makes good progress over the next 48 h, but then becomes very distressed with rapid shallow breathing, cough and worsening arterial blood gases, and a dense bilateral consolidation. Bronchoalveolar lavage reveals lymphocytosis and high granulocyte count. Gram stain is negative. She is intubated, transferred to the intensive care unit and placed on broad-spectrum antibiotics. Despite assisted ventilation, she continues to deteriorate over the next few hours with severe hypoxaemia (P_{aO_2} 6.0 kPa (45 mmHg) on F_{IO_2} 1.0). Cardiac output needs to be supported with dobutamine in order to sustain a mean arterial blood pressure of 70 mmHg.
Which one of the following is the next, most appropriate additional treatment?

a. High-dose inhaled corticosteroids
b. Vancomycin
c. Extracorporeal membrane oxygenation
d. Intra-aortic balloon pump
e. Prone ventilation

Correct answer

c. Extracorporeal membrane oxygenation

The mortality and morbidity of patients with severe acute respiratory distress syndrome (ARDS) remains high despite advances in intensive care practice. The low-tidal-volume ventilation strategy (ARDS-Net protocol) has been shown to be effective in improving survival. Unfortunately, however, some patients have such severe ARDS that they cannot be managed with the ARDS-Net strategy. In these patients, rescue therapies, such as high-frequency ventilation, prone ventilation, nitric oxide and extracorporeal membrane oxygenation (ECMO) are considered. The CESAR (Conventional Ventilation or ECMO for Severe Adult Respiratory Failure) trial has shown that an ECMO-based protocol improved survival without severe disability, compared with conventional ventilation. The recent increased incidence of severe respiratory failure due to the H1N1 influenza pandemic has led to an increased use of ECMO. A definitive role for intravenous corticosteroids in the treatment of ARDS in adults has not been established and inhaled corticosteroids are ineffective. There is no evidence in the described case of bacterial infection warranting vancomycin. Neither of those two options would immediately improve oxygenation. There is no reason to implant a balloon pump, since mean arterial pressure is sufficient with dobutamine.

References

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HERMES Syllabus link: 18 Respiratory failure
Angoff rating: 40%

Question 178

Which of the following statements about the diagnosis of pleural mesothelioma is/are correct?

a. Negative cytology is sufficient to rule out a diagnosis in a patient with a pleural mass and a history of asbestos exposure.
b. Fine-needle biopsy is recommended for the diagnosis if the patient is unfit for thoracoscopy.
c. Thoracoscopy is the procedure of choice for the diagnosis.
d. Immunohistochemistry is used to confirm the diagnosis.

Correct answers

b. Fine-needle biopsy is recommended for the diagnosis if the patient is unfit for thoracoscopy.
c. Thoracoscopy is the procedure of choice for the diagnosis.
d. Immunohistochemistry is used to confirm the diagnosis.

Diagnosis of pleural mesothelioma should not be based on cytology, as the sensitivity is poor (~30%). Fine-needle aspiration is not recommended unless the patient is unfit, as the sensitivity and specificity are lower than those of thoracoscopy, which is the diagnostic gold standard. Immunohistochemistry is essential to differentiate mesothelioma from adenocarcinoma and squamous and transitional cell carcinoma. Presently, there is no evidence that there is any appropriate screening modality for mesothelioma. Asbestos fibres can sometimes be found, especially if there was a high asbestos load. In rare cases, mesothelioma can develop without asbestos exposure.

References

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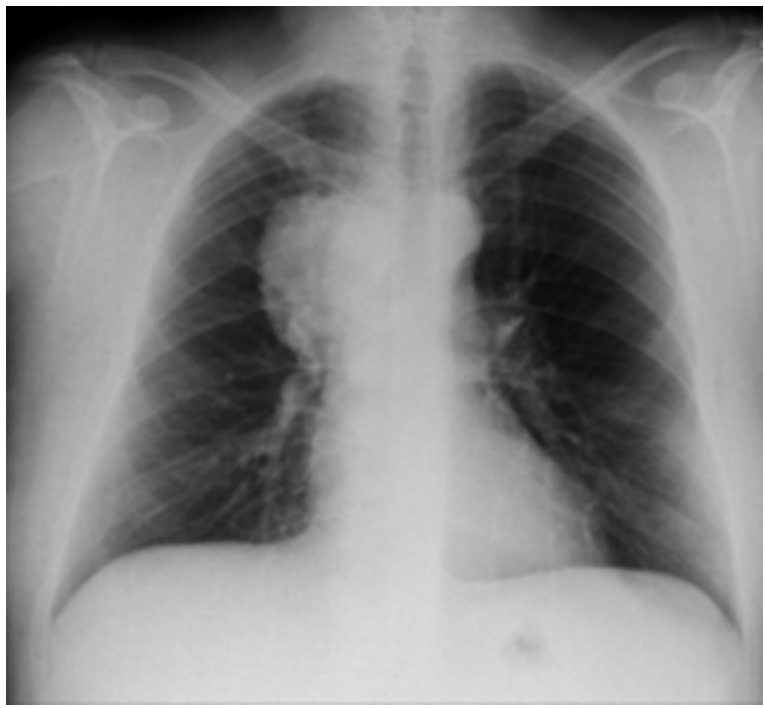
HERMES Syllabus link: 4 Other diagnostic procedures, 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 64%

Question 179

A 47-year-old restaurant owner with a 50 pack-year history of cigarette smoking presents with a productive cough with blood-streaked sputum. The physical examination is normal. The patient has an unremarkable past medical history and is taking no medications. Laboratory studies reveal a haemoglobin of 120 $g \cdot L^{-1}$ and haematocrit of 37%. Serum sodium is 124 $mmol \cdot L^{-1}$, potassium is 4.2 $mmol \cdot L^{-1}$, chloride is 97 $mmol \cdot L^{-1}$ and bicarbonate is 24 $mmol \cdot L^{-1}$. Kidney and liver function tests are normal. The chest radiograph is shown in the figure. Bronchoscopy reveals a partially occluded right mainstem bronchus 3 cm below the main carina by an extrinsically compressing mass appearing to erode through the medial wall of the right mainstem bronchus. Brush cytology specimens are positive for tumour cells.



Which of the following is the most likely lung carcinoma causing this clinical presentation?

a. Large cell undifferentiated carcinoma
b. Adenocarcinoma with lepidic growth
c. Squamous cell carcinoma
d. Small cell carcinoma
e. Adenocarcinoma

Correct answer

d. Small cell carcinoma

Small cell lung carcinoma (SCLC) is an aggressive form of lung cancer that is strongly associated with cigarette smoking and has a tendency for early dissemination. It appears as hilar or perihilar mass often with mediastinal lymphadenopathy and lobar collapse. Some SCLCs produce antidiuretic hormone (ADH) and the clinical SIADH (syndrome of inappropriate antidiuretic hormone) has been reported to occur in 7–16% of SCLC cases. ~70% of paraneoplastic SIADH cases are associated with SCLC. SIADH manifests as euvolaemic hypo-osmolar hyponatraemia characterised by low serum osmolality and inappropriately high urine osmolality in the absence of diuretic treatment, adrenal insufficiency, heart failure, cirrhosis or hypothyroidism. Patients feel tired and weak. The majority of squamous cell lung carcinomas arise centrally in the mainstem, lobar or segmental bronchi, but have been reported as a rare cause of SIADH.
Compared with other lung cancers, adenocarcinomas are most frequently peripheral nodules and infrequently present in a central location as a hilar or perihilar mass. In adenocarcinoma with lepidic growth neoplastic cells spread along pre-existing alveolar structures without evidence of stromal, vascular, or pleural invasion. Most large cell carcinomas are peripheral and ectopic hormone production is uncommon.

References

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HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 57%

Question 180

A 50-year-old female nonsmoker presents to the emergency unit with severe cough and non-purulent sputum production for 6 weeks, becoming worse in the last 3 days. She has no fever but has lost 4 kg body weight. On bronchoscopy, adenocarcinoma positive for the marker thyroid transcription factor-1 was diagnosed in transbronchial biopsies of the left lower lobe and a right-sided paratracheal fine-needle aspiration of a lymph node.
Which of the following tests has the highest probability of being positive and may alter treatment?

a. Anaplastic lymphoma kinase (*ALK*) fusion oncogene rearrangements in tissue specimens
b. Epidermal growth factor receptor (*EGFR*) mutation analysis in tissue specimens
c. Mucin-1 cancer antigen (CA15-3) in serum
d. Kirsten rat sarcoma (KRAS) protein in serum
e. Neuron-specific enolase in serum

Correct answer

b. Epidermal growth factor receptor (*EGFR*) mutation analysis in tissue specimens

Non-small cell lung cancer (NSCLC) subtyping has recently become important in determining patient management with novel drugs. The identification of distinct mutations frequently associated with NSCLC has an increasingly important impact on lung cancer treatment. Several molecular alterations involving various genes, such as *EGFR*, *KRAS* and *ALK*, seem to have a remarkable predilection for adenocarcinoma. Specific inhibitors of EGFR and ALK are now available for patients with adenocarcinoma harbouring the relevant gene alterations. First-line gefitinib improves progression-free survival in patients with advanced NSCLC who are selected on the basis of *EGFR* mutations. Crizotinib is superior to standard first-line pemetrexed–platinum-based chemotherapy in patients with previously untreated advanced *ALK*-positive NSCLC. However, *EGFR* mutations are found much more often than *ALK* rearrangements, including in nonsmoking females. The need to generate increasing amounts of genomic information has to be considered when planning diagnostic procedures. Serum tumour markers do not contribute to the choice of therapy.

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HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 62%

Question 181

A 45-year-old smoker is admitted to hospital after a motorcycle accident. He is otherwise in good health and his previous history is unremarkable. A thoracoabdominal CT is performed that shows an absence of traumatic lesions but discloses a 4-mm nodule in the left upper lobe, defined as a solid noncalcified opacity. There is no previous radiological examination available.
What is the most appropriate management strategy?

a. Follow-up low-dose CT every 3 months, up to 24 months if stable
b. Follow-up low-dose CT at 12 months, no additional follow-up if stable
c. Fluorodeoxyglucose positron emission tomography imaging and lobectomy if positive
d. Diagnostic wedge resection
e. Transthoracic needle biopsy

Correct answer

b. Follow-up low-dose CT at 12 months, no additional follow-up if stable

Evaluation of pulmonary nodules is based on radiological characteristics and clinical probability of malignancy (table). Follow-up low-dose CT for a lung nodule ≤4 mm, in a high-risk patient such as a smoker, should be performed at 12 months and, if it is stable, no additional follow-up is required. Positron emission tomography (PET) is appropriate for the evaluation of lung nodules ≥8 mm and should be performed in patients with low to intermediate risk of lung cancer. High-risk nodules ≥8 mm should be biopsied or excised. Nonsurgical biopsy is a choice for low to intermediate risk lung nodules ≥8 mm with either negative or positive PET.

Table Assessment of the probability of malignancy

Assessment criteria	Probability of malignancy		
	Low (<5%)	**Intermediate (5–65%)**	**High (>65%)**
Clinical factors alone (determined by clinical judgment and/or use of validated model)[#]	Young, less smoking, no prior cancer, smaller nodule size, regular margins and/or non-upper lobe location	Mixture of low- and high-probability features	Older, heavy smoking, prior cancer, large size, irregular/spiculated margins and/or upper lobe location
FDG-PET results	Low–moderate clinical probability and low FDG-PET activity	Weak or moderate FDG-PET activity	Intensely hypermetabolic nodule
Nonsurgical biopsy results (bronchoscopy or TTNA)	Specific benign diagnosis	Nondiagnostic	Suspicious for malignancy
CT surveillance	Resolution or near-complete resolution, progressive or persistent decrease in size[¶]	NA	Clear evidence of growth

FDG: fluorodeoxyglucose; PET: positron emission tomography; TTNA: transthoracic needle aspiration; NA: not applicable. [#]: in three studies, independent risk factors for malignancy included older age, current or former smoking, history of extrathoracic cancer >5 years prior to nodule detection, larger nodule diameter, spiculated margins and upper-lobe location; [¶]: approximately 20% of observed cancers have decreased in size at least at some point during the observation period. Reproduced from Gould *et al.* (2013).

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HERMES Syllabus link: 4 Other diagnostic procedures, 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 57%

Question 182

Which of the following statements concerning occupational sensitivity to latex is/are true?

a. It causes asthma attacks.
b. It is strongly associated with atopy.
c. The most common symptom is cough.
d. The antigen cross-reacts with birch pollen.

Correct answers

a. It causes asthma attacks.
b. It is strongly associated with atopy.
c. The antigen cross-reacts with birch pollen.

Natural rubber latex is often found in surgical gloves, balloons and condoms. Occupational latex sensitisation, therefore, is quite frequent among healthcare professionals. Approximately 50% of patients with latex sensitisation are atopic. Due to the dermal sensitisation by gloves, skin symptoms are most frequently observed. Asthma, however, also occurs as allergic reaction to latex. More than 13 proteins have been identified as being responsible for allergic reactions. Corn starch powder, which is used to powder the gloves, is known to increase the sensitisation by the proteins. Banana, kiwi, avocado and tomato are known to cross-react with latex; the same is true for birch pollen.

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HERMES Syllabus link: 15 Occupational diseases
Angoff rating: 54%

Question 183

Which one of the following statements concerning interventions aimed at promoting smoking cessation in patients with COPD is not correct?

a. Smoking cessation interventions are successful at 1 year in >65% of patients.
b. Successful interventions improve survival.
c. Interventions should include psychosocial support and pharmacological treatment.
d. Nicotine replacement therapy may increase the success rate.
e. Varenicline is superior to psychosocial support alone.

Correct answer

a. Smoking cessation interventions are successful at 1 year in >65% of patients

At the end of a dedicated smoking cessation intervention in COPD patients, more than 50% quit smoking. After 1 year, 20–40% still refrain from smoking. Smoking cessation in COPD patients is more difficult than in smokers without COPD, due to common comorbidities such as depression in COPD patients. While randomised controlled trials using bronchodilators have failed to show an improvement in mortality, trials on smoking cessation interventions have shown an improvement. The largest study on smoking cessation in COPD to date is the Lung Health Study, with over 5000 patients followed up for 15 years on an intention-to-treat basis. The Lung Health Study used an intense smoking cessation programme in conjunction with a nicotine patch. The 1-year quit rate was 40%. Varenicline has been studied to a much lesser degree than nicotine replacement therapy. However, a recent study in patients with COPD showed that varenicline was about twice as effective as placebo.

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HERMES Syllabus link: 6 Airway diseases
Angoff rating: 69%

Question 184

A 53-year-old insulation worker with probable former asbestos exposure presents to the emergency department with new-onset dyspnoea. Chest ultrasound reveals a right-sided pleural effusion. Which of the following finding(s) on a CT image would further support previous exposure to asbestos?

a. Calcified pleural plaques
b. Pleural thickening
c. Pulmonary fibrosis
d. Partial lower lobe atelectasis (rounded atelectasis)

Correct answers

a. Calcified pleural plaques
b. Pleural thickening
c. Pulmonary fibrosis
d. Partial lower lobe atelectasis (rounded atelectasis)

Calcified pleural plaques are a typical marker of asbestos exposure, mostly not associated with symptoms or functional impairment. In rare cases, pleural calcifications can cause slightly restrictive pulmonary function. Benign pleural thickening is one of the well-known sequela of asbestos exposure. Pulmonary fibrosis is a "dose-dependent" complication of asbestos exposition. Partial atelectasis, most often presenting in the lower lobes, is sometimes found in patients previously exposed to asbestos. The mechanism of its origin is not yet completely clear. Rounded atelectasis (otherwise known as pulmonary pseudotumour or Blesovsky's syndrome) is an important benign differential diagnosis for chest radiograph abnormalities that may mimic lung cancer. It is important to consider this possibility to avoid unnecessary invasive investigation and patient anxiety.

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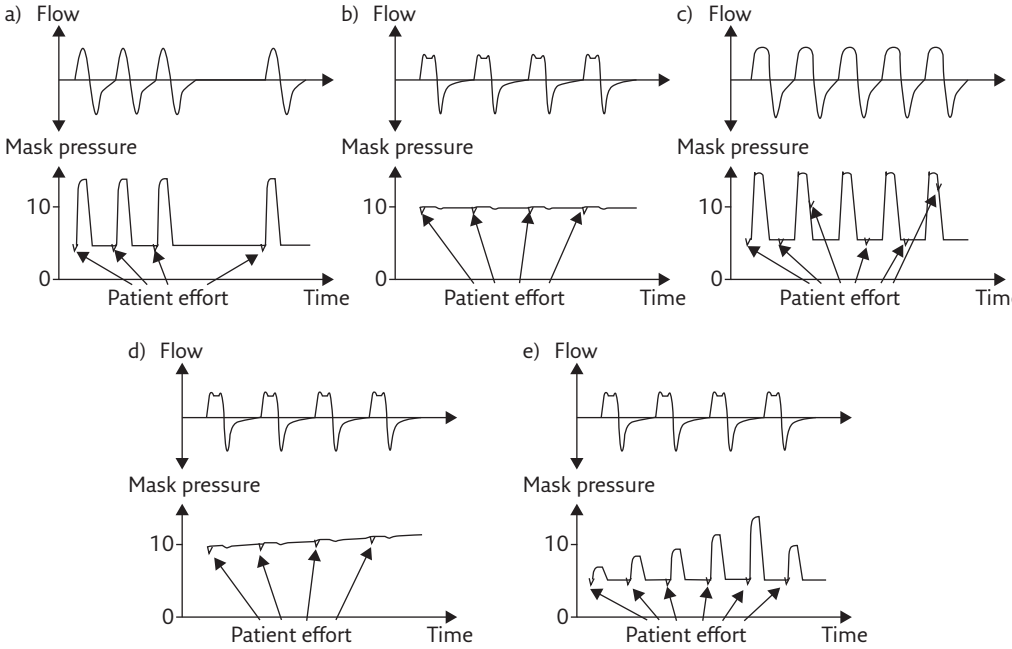
HERMES Syllabus link: 15 Occupational diseases, 20 Pleural diseases
Angoff rating: 67%

Question 185

A 48-year-old lorry driver suffers from excessive sleepiness and shortness of breath on minimal exertion. He has gained 35 kg in the last 10 years and now weighs 165 kg. The patient's BMI is 46 $kg \cdot m^{-2}$. His blood pressure is 135/90 mmHg and his pulse rate is 76 beats per min. He has bilateral leg oedema and neck vein distension. His second heart sound is accentuated. Lung auscultation is normal. An arterial blood gas analysis on room air reveals a P_{aO_2} of 6.9 kPa (52 mmHg), P_{aCO_2} of 8.6 kPa (65 mmHg), pH of 7.33, S_{pO_2} of 87% and serum bicarbonate concentration of 33 $mmol \cdot L^{-1}$. A sleep study shows a mean nocturnal oxygen saturation of 83% and an AHI of 58 events per h, with predominantly obstructive apnoeas/hypopnoeas, some central apnoeas of up to 55 s in duration and several periods of rapid eye movement sleep-associated periods of hypoventilation with increases in P_{tcCO_2}. You decide to start the patient on nocturnal continuous positive airway pressure therapy *via* an oral–facial mask. After 4 weeks, the patient does not report a clear improvement in sleepiness. Therefore, you decide to change the mode of ventilation.
Which one of the modes schematically depicted below is most appropriate?



Correct answer

a. Spontaneous-mode bilevel positive airway pressure (as shown in the schematic drawing).

The clinical context and laboratory studies indicate that this patient suffers from obesity hypoventilation syndrome (OHS). This condition is defined by the association of obesity BMI >30 $kg \cdot m^{-2}$) with daytime hypoventilation (P_{aO_2} >6.0 kPa (>45 mmHg)) in the absence of other causes of hypoventilation, such as neuromuscular or pulmonary diseases. Sleep-related hypoventilation and obstructive sleep apnoeas/hypopnoeas are not part of the definition of OHS but are often present in affected patients. Patients with OHS suffer from dyspnoea on exertion and excessive daytime sleepiness. Comorbidities such as diabetes, systemic hypertension and pulmonary hypertension with right ventricular heart failure are often present. Treatment of OHS includes nocturnal positive pressure therapy with or without supplemental oxygen and weight loss with dietary measures and bariatric surgery. Nocturnal CPAP (answer b) is the first treatment approach in many patients with OHS and may be supplemented by oxygen if severe hypoxaemia persists. CPAP improves obstructive apnoeas/hypopnoeas, flow limitation and snoring, thereby contributing to reversal of hypoventilation. Normocapnia may not be achieved within a few days but may require prolonged treatment. If hypoxaemia and hypercapnia persist, bilevel positive airway pressure therapy may be started. Current bilevel ventilators can be operated in the spontaneous mode (answer a), in which the patient triggers an assisted breath but the machine does not provide additional support. This mode was used in the study by Piper *et al*. (2008). In the timed mode (answer c), the ventilator provides assisted breaths at the preset rate without synchronisation with the patient, which may be perceived as uncomfortable by some patients. In the spontaneous timed mode (not shown), the patient may trigger assisted breaths and the ventilator provides additional support if the respiratory rate of the patient falls below the pre-set rate. In the adaptive pressure support mode (answer e), the inspiratory pressure support is adjusted from breath to breath to stabilise periodic breathing in patients with Cheyne–Stokes respiration or central sleep apnoea. Although superiority of one over the other modes of bilevel assisted ventilation has not been established in randomised, controlled studies, the spontaneous bilevel mode is recommend. Since the patient did not improve on CPAP, this mode with fixed (answer b) or auto-adjusting pressure (answer d) does not seem promising.

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Mokhlesi B, *et al*. Assessment and management of patients with obesity hypoventilation syndrome. *Proc Am Thorac Soc* 2008; 5: 218–225.

Piper AJ, *et al*. Randomised trial of CPAP *vs* bilevel support in the treatment of obesity hypoventilation syndrome without severe nocturnal desaturation. *Thorax* 2008; 63: 395–401.

HERMES Syllabus link: 18 Respiratory failure, 22 Sleep and control of breathing disorders
Angoff rating: 36%

Question 186

A 27-year-old female in the 22nd week of pregnancy presents to her family physician because of recent onset of dyspnoea on moderate exertion and cough without sputum production causing frequent nocturnal awakening. She had been treated for bronchial asthma with inhaled corticosteroids and long-acting β-adrenergic agonists but stopped treatment at the beginning of the pregnancy because of fear of adverse effects on the fetus. On physical examination, she is in good general condition but lung auscultation reveals slight bilateral wheezing. Spirometry shows FVC of 90% predicted, FEV_1 of 50% predicted and FEV_1/FVC ratio of 55%. After inhalation of two puffs of salbutamol, FEV_1 improved to 90% predicted while FVC remained 90% predicted.
Which one of the following recommendations is most appropriate for this patient?

a. Stop treatment because asthma becomes less severe during pregnancy.
b. Restart inhaled corticosteroids.
c. Avoid systemic corticosteroids during pregnancy.
d. Avoid short-acting β-adrenergic agonists during pregnancy.
e. Restart long-acting β-adrenergic agonists.

Correct answer

b. Restart inhaled corticosteroids.

Asthma is a very common respiratory disease and therefore the number of pregnant women with asthma is also high. There is no clear trend of change in asthma control during pregnancy. However, women with asthma are strongly advised to continue their usual treatment as before pregnancy. There is no evidence that standard asthma therapy is unsafe in pregnancy and labour. Acute exacerbations should be managed in hospital with foetal monitoring and with use of steroids as needed. Maternal S_{aO_2} should be kept above 95%. During labour, it is advisable to give 100 mg of hydrocortisone every 6 hours in patients who were on systemic steroids with doses of more than 7.5 mg prednisolone for the preceding 2 weeks. Although β-adrenergic agonists reduce uterine contraction, it is not advisable to compromise maternal lung function during labour by withholding them. β-adrenergic blockers, prostaglandin F2 and nonsteroidal antirheumatic drugs (in sensitive subjects) should be avoided, since they can cause bronchospasm.

References

Murphy VE, *et al.* Asthma in pregnancy *Clin Chest Med* 2011; 32: 93–110.

Schatz M. Asthma and Rhinitis during pregnancy. *In*: Busse WW, *et al.*, eds. Asthma and Rhinitis. 2nd Edn. Oxford, Blackwell Science, 2000; pp. 1811–1826.

HERMES Syllabus links: 6 Airway diseases, 23 Pregnancy
Angoff rating: 68%

Question 187

A patient with very severe COPD has an FVC of 2.7 L (60% of predicted), FEV_1 of 0.8 L (25% of predicted) and FEV_1/FVC of 30%.
In which of the following is a therapeutic exercise programme likely to result?

a. An increase in FEV_1
b. An increase in 6-min walking distance
c. A decrease in oxygen extraction by muscles
d. An increase in resting P_{aO_2}
e. A decrease in resting P_{aCO_2}

Correct answer

b. An increase in 6-min walking distance

In severe and very severe COPD patients (*i.e.* those with an FEV_1 <50% predicted), pulmonary rehabilitation results in improvement of health-related quality of life, dyspnoea and exercise tolerance (as measured, for example, by exercise tests, including the 6-min walk test). Pulmonary rehabilitation has no effect on lung function (FEV_1) or blood gases. Oxygen extraction by skeletal muscles increases rather than decreases after exercise training.

References

Lacasse Y, *et al.* Pulmonary rehabilitation for chronic obstructive pulmonary disease. *Cochrane Database Syst Rev* 2006; CD003793.

Qaseem A, *et al.* Diagnosis and management of stable chronic obstructive pulmonary disease: a clinical practice guideline update from the American College of Physicians, American College of Chest Physicians, American Thoracic Society, and European Respiratory Society. *Ann Intern Med* 2011; 155: 179–191.

Spruit MA, *et al.* An official American Thoracic Society/European Respiratory Society statement: key concepts and advances in pulmonary rehabilitation. *Am J Respir Crit Care Med* 2013; 188: e13–e64.

HERMES Syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases
Angoff rating: 73%

Question 188

A 48-year-old man has had a recent onset of numbness and paraesthesia of his feet. He has an 8-year history of intermittent wheezing and shortness of breath. Physical examination reveals mild expiratory wheezes, a skin rash consisting of small purpuric lesions over the lower extremities, and loss of sharp/blunt distinction over the lower extremities. His chest radiograph shows mild hyperinflation but is otherwise normal. His white blood cell count is 14000 per μL with 7% neutrophils, 20% eosinophils and 10% lymphocytes. His erythrocyte sedimentation rate is 70 $mm \cdot h^{-1}$. His serum antinuclear antibody titre is 1:40 with a speckled pattern. Biopsy of a skin lesion shows necrotising granulomatous lesions with a dense infiltrate of eosinophils and a capillaritis.
Which of the following is the most likely diagnosis?

a. Polyarteritis nodosa
b. Systemic lupus erythematosus
c. Eosinophilic granulomatosis with polyangiitis
d. Granulomatosis with polyangiitis
e. Necrotising sarcoid granulomatosis

Correct answer

c. Eosinophilic granulomatosis with polyangiitis

The symptoms and clinical findings of this patient are typical for the diagnosis of eosinophilic granulomatosis with polyangiitis. This is a vasculitis of small vessels with variable medium-sized vessel involvement. It often occurs in patients who suffer from late-onset asthma associated with eosinophilia in peripheral blood and/or tissue. The American College of Rheumatology defined the following diagnostic criteria:

- Asthma
- Eosinophilia (>10% eosinophils)
- Neuropathy in a vasculitic pattern (*e.g.* mononeuritis multiplex)
- Transient pulmonary infiltrates
- Paranasal sinus abnormality
- Extravascular eosinophilia on biopsy

For classification purposes, a patient is said to have eosinophilic granulomatosis with polyangiitis if at least four out of these six criteria are positive. The typical finding in lung biopsies is necrotising angiitis, granuloma and tissue eosinophilia. Perinuclear anti-neutrophil cytoplasmic antibodies are present in up to two-thirds of patients but also occur in many other autoimmune and infectious diseases.

References

Groh M, *et al.* Eosinophilic granulomatosis with polyangiitis (Churg–Strauss) (EGPA) Consensus Task Force recommendations for evaluation and management. *Eur J Intern Med* 2015 [In press DOI: 10.1016/j.ejim.2015.04.022].

Margaritopoulos G, *et al.* Pulmonary vasculitis. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 417–421.

Masi AT, *et al.* The American College of Rheumatology 1990 criteria for the classification of Churg–Strauss syndrome (allergic granulomatosis and angiitis). *Arthritis Rheum* 1990; 33: 1094–1100.

HERMES Syllabus link: 12 Eosinophilic diseases, 14 Pulmonary vascular diseases
Angoff rating: 54%

Question 189

Which one of the following statements about lymphangioleiomyomatosis is true?

a. A pleural effusion, if present, is usually a lymphocytic exudate.
b. The presence of kidney angiomyolipomas or lymphangioleiomyomas is necessary for the diagnosis.
c. The risk of pneumothorax is greater in pregnancy.
d. Lung function is usually characterised by a restrictive pattern with decreased T_{LCO}.

Correct answer

c. The risk of pneumothorax is greater in pregnancy.

Pleural effusions in lymphagioleiomyomatosis (LAM) are usually chylous, commonly accompanied by chylous ascites.
The presence of kidney angiomyolipomas or lymphangioleiomyomas is not necessary for the diagnosis of LAM in patients with compatible HRCT and/or biopsy-proven pathology compatible with LAM, or in the presence of chylous effusions or tuberous sclerosis. The risks of pneumothorax and of chylous effusions are both increased during pregnancy and represent two of the most important problems of patients with LAM during pregnancy.
Lung function in LAM is typically characterised by airflow obstruction, combined with a reduced diffusing capacity.

References

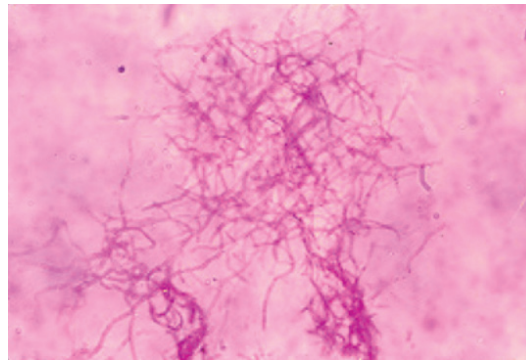
Cottin V, *et al.* Lymphangioleiomyomatosis. *In*: Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 535–538.

Johnson SR, *et al.* European Respiratory Society guidelines for the diagnosis and management of lymphangioleiomyomatosis. *Eur Respir J* 2010; 35: 14–26.

HERMES Syllabus link: 6 Airway diseases, 25 Orphan and rare lung diseases
Angoff rating: 38%

Question 190

A 57-year-old male with a history of ischaemic heart disease, intermittent claudication, alveolar proteinosis and diabetes, with poor adherence to his medications, presents with a cough, wheeze and phlegm of several weeks' duration. He has had low-grade fever and lost 4 kg in weight. Microscopic sputum examination reveals weakly acid fast-staining, filamentous branching organisms. A Ziehl–Neelsen stain of the patient's sputum is shown below (reproduced from Sullivan *et al.* (2011), with permission from the publisher).



Which one of the following is the most likely diagnosis?

a. Nocardiosis
b. Blastomycosis
c. *Bacteroides* infection
d. *Klebsiella* infection
e. Actinomycosis

Correct answer

a. Nocardiosis

Nocardia infects the lungs, brain and skin, particularly in people with an impaired immune system. The majority (about 80%) of cases of nocardiosis involve lung infection, brain abscess, or disseminated (widespread) disease from *Nocardia*. The most common symptoms of the pulmonary form of nocardiosis are fever, cough and chest pain. The presence of beaded, branching, Gram-positive bacilli in a clinical specimen with weak acid-fast staining is consistent with *Nocardia* species. *Nocardia* is ubiquitous in the environment. It is in the soil and in dust particles. The inhalation of *Nocardia* spores usually initiates pulmonary nocardiosis. The skin form of nocardiosis is contracted through soil contamination of wounds. There is no evidence for person-to-person transmission of *Nocardia*. Outbreaks of nocardiosis can occur in immunocompromised patients, including persons with malignancy, connective tissue disorders, bone-marrow transplantation or solid-organ transplantation, high-dose corticosteroid use, and HIV/AIDS. *Nocardia* is a common complication of alveolar proteinosis.

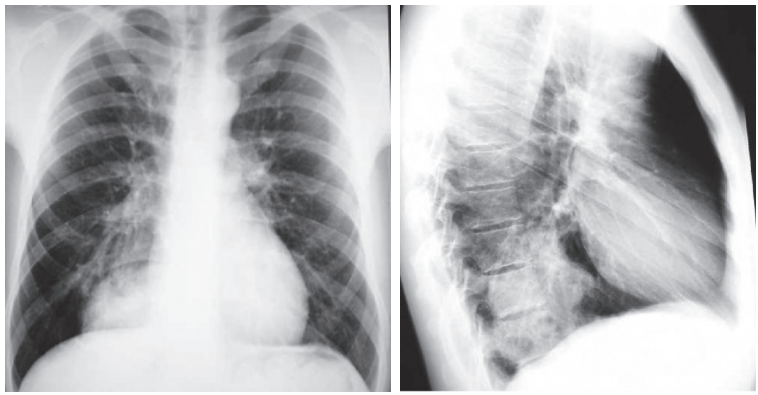
Reference

Sullivan DC, *et al.* Bacteria that masquerade as fungi. *Proc Am Thorac Soc* 2011; 7: 216–221.

HERMES Syllabus link: 7 Respiratory infections, 25 Orphan and rare lung diseases
Angoff rating: 37%

Question 191

A 29-year-old smoker is referred because of recurrent pneumonia of the right lower lobe over the last 3 years. Each time, he promptly responds to antibiotic therapy. Between pneumonic episodes, the patient is well. His chest radiographs are shown below.



Which is the most likely diagnosis?

a. Bronchogenic cyst
b. Bronchopulmonary sequestration
c. Chronic pneumonia
d. Foreign body aspiration
e. Neoplasm

Correct answer

b. Bronchopulmonary sequestration

The chest radiographs reveal a homogeneous opacity in the posterior basal segment of the right lower lobe, contiguous with the hemidiaphragm. Although the radiological differential diagnosis includes all answer options, the most probable diagnosis is that of intralobar bronchopulmonary sequestration, as its most common presentation is in the posterior basal segment of lower lobes; clinical manifestations such as those of recurrent lower lobe pneumonia are frequent and occur usually in children/young adults.

Reference

Palmowski M, *et al.* Bronchopulmonary sequestration: a differential diagnosis in young adults for recurrent pneumonia. *Lancet* 2007; 369: 1318.

HERMES Syllabus link: 4 Other diagnostic procedures, 26 Genetic and developmental disorders, 27 Associated specialties
Angoff rating: 69%

Question 192

A 57-year-old male with ischaemic heart disease is admitted with an episode of acute pulmonary oedema. Assessment shows a systolic blood pressure of 140 mmHg, S_{pO_2} of 89%, P_{aO_2} 7.8 kPa (59 mmHg), P_{aCO_2} 3.5 kPa (26 mmHg) and pH of 7.34 in room air. After establishing initial therapy with nitrates, oxygen and loop diuretics, the emergency department team request your advice on the use of NIV or CPAP therapy.
Which of the following statements regarding treatment of this patient is/are true?

a. NIV reduces breathlessness.
b. NIV is superior to CPAP in reducing mortality.
c. Intubation rate is reduced by use of NIV.
d. NIV increases the risk of acute myocardial infarction.

Correct answer

a. NIV reduces breathlessness.

The evidence to support the use of CPAP and NIV is not as clear-cut in acute cardiogenic pulmonary oedema as it is for the use of NIV in acute hypercapnic exacerbations of COPD. Key issues in the management of acute cardiogenic pulmonary oedema are to: 1) establish the diagnosis by history, chest radiograph and biomarker (brain natriuretic protein) level; 2) assess severity (blood pressure, tachycardia, jugular venous pressure, urine output and S_{aO_2}); 3) determine cause (myocardial ischaemia, arrhythmia, acute valvular disease, deteriorating renal function, chest infection, comorbidity, *etc.*); 4) preserve myocardial function; and 5) relieve symptoms. Key medical interventions are oxygen therapy, nitrates, loop diuretics, opioids and therapy directed to the primary cause.

There have been a series of meta-analyses and systematic reviews pooling data from relatively small studies of the use of CPAP *versus* standard therapy, bilevel NIV *versus* standard therapy and bilevel NIV *versus* CPAP. While the pooled data suggest improvement in mortality/intubation rates with CPAP and NIV, there was no difference between these modalities and a subsequent large randomised clinical trial (3CPO) showed that while NIV produced an early reduction in breathlessness and improvement in physiological variables, this did not translate into an improvement in mortality. This discrepancy may be explained by differences in patient populations, inconsistency of delivery of CPAP/NIV, differing criteria for intubation and the influence of co-therapy. Other authors showed that pre-hospital nitrate was the only treatment related to improved survival in a UK study. Medical therapy should therefore always be optimised. NIV reduced intubation rate in a hypercapnic subgroup. While an early small study suggested an increase in myocardial rate in patients treated with NIV, this has not borne out in the large 3CPO trial and meta-analyses.

References

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Masip J, *et al.* Non-invasive ventilation in acute cardiogenic pulmonary oedema:systematic review and meta-analysis. *JAMA* 2005; 294: 3124–3130.

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Crane SD. Epidemiology, treatment and outcome of acidotic, acute cardiogenic oedema presenting to an emergency department. *Eur J Emerg Med* 2002; 9: 320–324.

Nava S, *et al.* Non-invasive ventilation in cardiogenic pulmonary oedema: a multicentre randomised trial. *Am J Respir Crit Care Med* 2003; 168: 1432–1437.

HERMES Syllabus link: 18 Respiratory failure
Angoff rating: 55%

Question 193

Which of the following statements concerning cryptogenic organising pneumonia is correct?

a. It results in airflow limitation and hyperinflation.
b. It appears almost exclusively in smokers.
c. Histology reveals poorly formed interstitial granulomas.
d. Evaluation of the bronchoalveolar lavage cellular constituents is diagnostic.
e. The histologic appearance is nonspecific and may also result from a variety of lung injuries.

Correct answer

e. The histologic appearance is nonspecific and may also result from a variety of lung injuries.

Smoking is not related to the occurrence of cryptogenic organising pneumonia (COP). COP is associated with a restrictive not an obstructive ventilatory defect and is characterised histopathologically by intra-alveolar buds of granulation tissue, consisting of intermixed myofibroblasts and connective tissue. Poorly formed interstitial granulomas are features of hypersensitivity pneumonia, not of COP. Bronchoalveolar lavage fluid analysis shows a mixed cellular pattern with an increase in lymphocytes (20–40%), neutrophils (10%) and eosinophils (5%) with the level of lymphocytes higher than that of eosinophils; a few plasma cells and/or mast cells may be present in COP. The lymphocytes are activated and the CD4/CD8 ratio is usually decreased. This pattern is not specific for COP, and thus is not diagnostic. The histological appearance (see above) is characteristic, although not specific, and is shared by secondary forms of bronchiolitis obliterans with organising pneumonia that may result from a variety of lung injuries (including, but not limited to infectious agents, drugs and radiation).

Reference

Cordier J-F, *et al.* Cryptogenic organising pneumonia. *Eur Respir J* 2006; 28: 422–446.

HERMES Syllabus link: 10 Interstitial lung disease, 13 Respiratory consequences of systemic/extrapulmonary disorders
Angoff rating: 55%

Question 194

An obese (BMI 32.5 $kg \cdot m^{-2}$), diabetic man with arterial hypertension is diagnosed with OSA (AHI 45 events per h). In addition to weight loss, you recommend CPAP treatment.
What is an evidence-based benefit of your recommendation?

a. CPAP is superior to dietary attempts at weight reduction.
b. CPAP lowers systolic arterial blood pressure by >10 mmHg.
c. CPAP is superior to nocturnal oxygen therapy at lowering blood pressure.
d. CPAP and weight loss together are more effective at glycaemic control than either intervention alone.
e. CPAP is more effective at blood pressure control than weight loss after 6 months of intervention.

Correct answer

d. CPAP and weight loss together are more effective at glycaemic control than either intervention alone.

Epidemiological studies show that sleep apnoea independently increases the risk of cardiovascular disease. Individuals with severe sleep apnoea are at increased risk of coronary artery disease, congestive heart failure and stroke. The underlying mechanisms are not entirely understood. Linkage between OSA and cardiovascular disease is supported by evidence that treatment of sleep apnoea with CPAP reduces blood pressure; however, the effect is quite small, depending on previous treatment and symptoms. A recent meta-analysis showed a mean decrease in systolic blood pressure of 3.6 mmHg with CPAP therapy. In minimally symptomatic patients, the effect is even smaller. Several systematic studies are necessary to explain the complex associations between OSA and cardiovascular disease, which may be empowered by the involvement of diseases comprising the metabolic syndrome (*i.e.* central obesity, hypertension, diabetes and dyslipidaemia). Although CPAP might be expected to support weight loss by increasing physical daytime activity, there are no data supporting an effect of CPAP on weight reduction. Recent studies have shown that weight loss is more effective than CPAP but both interventions together are better than either alone at lowering blood pressure and insulin resistance, but not markers of inflammation such as C-reactive protein. Oxygen alone does not reduce blood pressure. Extensive weight loss as seen with gastric bypass surgery is very effective at glycaemic control; comparable effects have not been shown with CPAP.

References

Chirinos JA, *et al*. CPAP, weight loss, or both for obstructive sleep apnea. *N Engl J Med* 2014; 370: 2265–2275.

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Schauer PR, *et al*. Bariatric surgery versus intensive medical therapy for diabetes – 3-year outcomes. *N Engl J Med* 2014; 370: 2002–2013.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 61%

Question 195

Which of the following radiological findings is characteristic of pulmonary Langerhans' cell histiocytosis?

a. Patchy consolidation
b. Crazy paving
c. Honeycombing
d. Lower lobe-predominant changes
e. Cavitating nodules

Correct answer

e. Cavitating nodules

The most common radiological findings in pulmonary Langerhans' cell histiocytosis are nodular and cystic changes, which occur predominantly in the middle and upper lobes. Nodules may cavitate and disappear or evolve into thin-walled cysts. Patchy infiltrates and thick-walled cavitations are not features of the disease. Crazy paving is typically seen in alveolar proteinosis. To date, in the absence of a controlled therapeutic trial, there is no evidence for efficacy of any treatment for pulmonary Langerhans' cell histiocytosis, but smoking cessation may lead to improvement.

References

Cottin V, *et al.* Adult pulmonary Langerhans' cell histiocytosis. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 535–538.

Vassallo R. Pulmonary Langerhans'-cell histiocytosis. *New Engl J Med* 2000; 342: 1969–1978.

HERMES Syllabus link: 4 Other diagnostic procedures, 25 Orphan and rare lung diseases
Angoff rating: 55%

Question 196

A 46-year-old female never-smoker, domestic cleaner, with a BMI of 32.5 $kg \cdot m^{-2}$, is evaluated in an asthma clinic. She is receiving treatment from her family doctor, with salmeterol/fluticasone 50/500 twice daily and montelukast 10 mg once daily for the past 6 months. She has been taking salbutamol several times daily and has been waking up 1–2 times every night for the past 2 weeks. Which of the following comorbidities is not related to poor control of her asthma?

a. Chronic rhinosinusitis
b. Psychological dysfunctioning
c. Obesity
d. Asymptomatic gastro-oesophageal reflux
e. Thyroid disorders

Correct answer

d. Asymptomatic gastro-oesophageal reflux

Asthma control has two domains, *i.e.* symptom control and future risk of adverse outcomes. The table illustrates how to assess them. The question addresses risk factors for poor outcome. Gastro-oesophageal reflux (GOR) is present in 60–80% of patients with asthma, but clinical trials with proton pump inhibitor therapy generally show little to no effect on asthma control. The role of asymptomatic ("silent") GOR is not established and only treatment of symptomatic gastro-oesophageal reflux disease is recommended in current asthma guidelines. Chronic rhinosinusitis with or without the presence of nasal polyps is an established comorbidity related to poor asthma control. Obesity is also a common comorbidity associated with difficult-to-treat asthma that needs to be addressed in cases of poor asthma control. Anxiety and depression, and thyroid disorders have been associated with poor asthma control in several studies.

Table Assessment of symptom control and future risk

A. Level of asthma symptom control			
In the past 4 weeks, has the patient had:	**Well controlled**	**Partly controlled**	**Uncontrolled**
Daytime symptoms more than twice/week? Yes/No Any night waking due to asthma? Yes/No Reliever needed more than twice/week? Yes/No Any activity limitation due to asthma? Yes/No	None of these	1–2 of these	3–4 of these
B. Risk factors for poor asthma outcomes			
Assess risk factors at diagnosis and periodically, particularly for patients experiencing exacerbations.			
Measure FEV_1 at start of treatment, after 3–6 months of controller treatment to record personal best lung function, then periodically for ongoing risk assessment			
Potentially modifiable independent risk factors for exacerbation include: Uncontrolled asthma symptoms (as above) ICS not prescribed; poor ICS adherence; incorrect inhaler technique High SABA use (with increased mortality if >1×200-dose canister/month) Low FEV_1, especially if <60% predicted Major psychological or socioeconomic problems Exposures: smoking; allergen exposure if sensitised Comorbidities: obesity; rhinosinusitis; confirmed food allergy Sputum or blood eosinophilia Pregnancy		Having one or more of these risk factors increases the risk of exacerbations even if symptoms are well controlled	
Other major independent risk factors for flare-ups (exacerbations) include: Ever being intubated or in intensive care for asthma Having 1 or more sever exacerbation in the past 12 months			
Risk factors for developing fixed airflow limitation include lack of ICS treatment; exposure to tobacco smoke, noxious chemicals or occupational exposures; low FEV_1; chronic mucus hypersecretion; and sputum or blood eosinophilia			
Risk factors for medication side-effects include: Systemic: frequent OCS; long-term, high dose and/or potent ICS; also taking P450 inhibitors Local: high-dose or potent ICS; poor inhaler technique			

ICS: inhaled corticosteroid; SABA: short-acting β_2-agonist; OCS: oral corticosteroid. Reproduced from the GINA Pocket Guide for Asthma Management and Prevention 2015, © Global Initiative for Asthma (GINA) all rights reserved. Available from: www.ginasthma.org

References

Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention. www.ginasthma.org/local/uploads/files/GINA_Report_2015_May19.pdf Date last updated: May 19, 2015.

Chung KF, *et al.* International ERS/ATS guidelines on definition, evaluation and treatment of severe asthma. *Eur Respir J* 2014; 43: 343–373.

HERMES Syllabus link: 6 Airway diseases
Angoff rating: 49%

Question 197

Which of the following statement(s) concerning non-cystic fibrosis bronchiectasis in adults is/are true?

a. Male infertility suggests primary ciliary dyskinesia.
b. Measurement of serum immunoglublin IgG, IgA and IgM levels should be performed.
c. Sputum culture should be performed.
d. Inhaled corticosteroids should be prescribed.

Correct answers

a. Male infertility suggests primary ciliary dyskinesia.
b. Measurement of serum immunoglublin IgG, IgA and IgM levels should be performed.
c. Sputum culture should be performed.

Bronchiectasis and male infertility are associated with primary ciliary dyskinesia (PCD) but male infertility is not invariably present in ciliary dysfunction disorders. In females, there is a small risk of subfertility. Typically, patients with PCD have a long history of continuous coughing, chronic otitis and sinusitis, and sometimes dextrocardia or complete situs inversus. British Thoracic Society guidelines recommend that all patients with bronchiectasis be screened for antibody deficiency by measuring IgG, IgA and IgM levels. Routine assessments of immunoglobulin subclasses are, however, not recommended for screening. There is no evidence that inhaled corticosteroids are beneficial in non-cystic fibrosis bronchiectasis unless the patient also suffers from asthma. Sputum cultures are part of the routine follow-up examinations in order to identify colonising bacteria.

Reference

Pasteur MC, *et al.* British Thoracic Society guideline for non-CF bronchiectasis. *Thorax* 2010; 65: Suppl. 1, i1–i58.

HERMES Syllabus link: 6 Airway diseases
Angoff rating: 67%

Question 198

A 55-year-old man presents to the hospital with community-acquired pneumonia.
Which of the following is not a risk factor for an increased chance of death from this pneumonia?

a. A respiratory rate of 32 breaths per min
b. A blood pressure of 100/50 mmHg
c. A history of COPD and myocardial infarction
d. A two-fold elevation of alanine and aspartate transaminases
e. An elevated level of serum creatinine >220 $mmol \cdot L^{-1}$

Correct answer

d. A two-fold elevation of alanine and aspartate transaminases

Various tools of risk assessment in community-acquired pneumonia (CAP), such as the Pneumonia Severity Index (PSI) and CURB-65 score, have been validated so far. The CURB-65 rule (confusion, urea >7 mmol·L^{-1}, respiratory rate >30 breaths per min, systolic blood pressure <90 mmHg or diastolic blood pressure ≤60 mmHg, and age ≥65 years) is the most practical in its simplicity. In patients with a CURB-65 ≥1 (except age >65 years as the only criterion met), hospitalisation should be seriously considered, as the risk of mortality is intermediate/high. A two-fold increase in hepatic enzymes is not a risk factor in CAP. In contrast to the PSI, the CURB-65 score does not take into account comorbidities for the calculation of risk, although these have important implications for the risk of death, the decision to hospitalise and treatment.

References

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Woodhead M, *et al.* Guidelines for the management of adult lower respiratory tract Infections. *Clin Microbiol Infect* 2011; 17: Suppl. 6, E1–E59.

HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 72%

Question 199

Which of the following statements is/are correct regarding multidrug-resistant tuberculosis?

a. Directly observed therapy (DOT) is highly recommended.
b. One of the drugs used should be an injectable agent for which susceptibility is proven (other than streptomycin).
c. There is no cross-resistance between injectable agents.
d. When initiating therapy, at least four drugs to which there is *in vitro* susceptibility should be given.

Correct answers

a. Directly observed therapy (DOT) is highly recommended.
b. One of the drugs used should be an injectable agent for which susceptibility is proven (other than streptomycin).
d. When initiating therapy, at least four drugs to which there is *in vitro* susceptibility should be given.

The World Health Organization (WHO) and the European Union Standards for Tuberculosis Care state in their general principles for treatment of multidrug-resistant tuberculosis (MDR-TB) that the treatment regimen should consist of at least four drugs with either certain or almost-certain effectiveness. Furthermore, it is not appropriate to use drugs for which there is the possibility of cross-resistance. Besides the use of any of the first-line oral agents that are likely to be effective in a particular case, WHO principles recommend the use of an effective aminoglycoside or polypeptide by injection, a fluoroquinolone and an oral bacteriostatic second-line agent, preferably cycloserine. Kanamycin or amikacin are the first choice as an injectable agent, although there is a high rate of cross-resistance. Streptomycin is more toxic and there is a high rate of resistance in drug-resistant TB. Each dose in an MDR regimen is preferably given as DOT.

References

American Thoracic Society, *et al*. Treatment of tuberculosis. *Am J Respir Crit Care Med* 2003; 52: 1–77.

Falzon D, *et al.* WHO guidelines for the programmatic management of drug-resistant tuberculosis: 2011 update. *Eur Respir J* 2011; 38: 516–528.

Migliori GB, *et al.* European Union Standards for Tuberculosis Care. *Eur Respir J* 2012; 39: 807–819.

HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 51%

Question 200

For diagnosis of hypersensitivity pneumonitis, which of the following statements is true?

a. Precipitating serum antibodies (IgG) are very sensitive.
b. A normal alveoloarterial oxygen tension difference excludes hypersensitivity pneumonitis.
c. A delayed cutaneous skin reaction to an incriminated antigen has a high positive predictive value.
d. A negative allergen avoidance test has a high negative predictive value.
e. A normal differential cell count in the bronchial lavage fluid excludes an acute form of hypersensitivity pneumonitis.

Correct answer

e. A normal differential cell count in the bronchial lavage fluid excludes an acute form of hypersensitivity pneumonitis.

Precipitating serum antibodies are often not identified in hypersensitivity pneumonitis. One might have a normal alveoloarterial oxygen tension difference ($P_{A–aO_2}$) at rest in the early stage of the disease but an increasing $P_{A–aO_2}$ during exercise. A delayed skin reaction has not been proven to be of predictive value for hypersensitivity pneumonitis. It is possible that in cases of a chronic hypersensitivity pneumonitis, allergen avoidance might not lead to a quick resolution of symptoms. In acute forms of hypersensitivity pneumonitis, the cell count is typically abnormal, with an increase in total cell count, an increase in lymphocytes and, depending on the timing of the bronchoalveolar lavage, an increase in neutrophils.

References

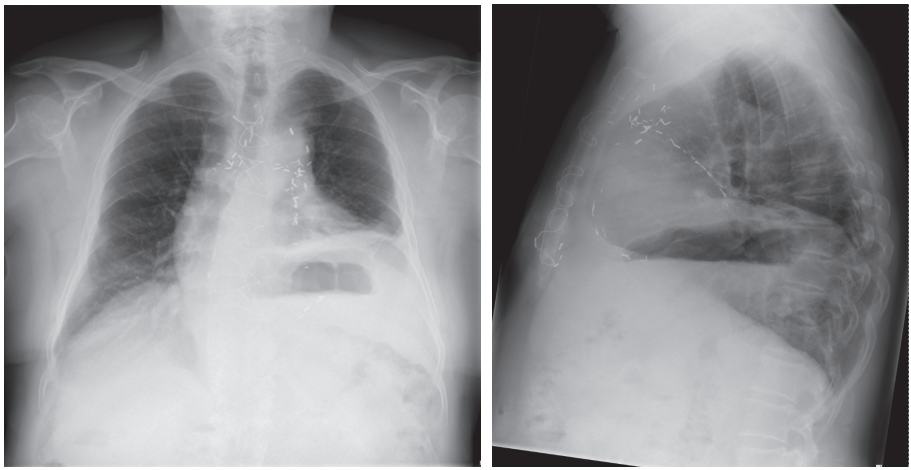
Bradley B, *et al.* Interstitial lung disease guideline: the British Thoracic Society in collaboration with the Thoracic Society of Australia and New Zealand and the Irish Thoracic Society. *Thorax* 2008; 63: Suppl. 5, v1–v558.

Lacasse Y, *et al.* Recent advances in hypersensitivity pneumonitis. *Chest* 2012; 142: 208–207.

HERMES Syllabus link: 10 Interstitial lung disease, 15 Occupational diseases, 16 Environmental diseases
Angoff rating: 50%

Question 201

A 56-year-old man is referred to you 6 days after surgery because of shortness of breath. He had a coronary artery bypass graft using the internal mammary artery. Extubation was routinely accomplished the day after surgery. Chest tubes were removed and the patient began to ambulate on the third post-operative day. At that time, he noticed shortness of breath with a gradual in onset that not associated with chest pain, sweating or tachypnoea. On physical examination, the patient is not cyanotic. He has a respiratory rate of 28 shallow breaths per min. Breath sounds are heard bilaterally but there is dullness at the left base, both anteriorly and posteriorly. The recent sternotomy wound appears not to be infected and no flail chest is present. The chest radiograph of the patient is shown below.



Bedside spirometry reveals a decrease in FVC of 50% from the pre-operative value. Arterial blood tests show a P_{aO_2} of 10.6 kPa (80 mmHg), and normal P_{aCO_2} and pH.
Which of the following tests is most likely to prove the cause of the shortness of breath?

a. D-dimer test
b. Fluoroscopy with sniff test
c. Lateral decubitus chest radiograph
d. Pulmonary angiography
e. CT scan of the chest

Correct answer

b. Fluoroscopy with sniff test

A D-dimer test is often positive after surgery and is therefore not useful in post-operative evaluation of pulmonary embolism. Pulmonary angiography is not indicated because of the patient's low risk of pulmonary embolism. His physical examination reveals dullness at the left base, corresponding to an elevation of the left diaphragm in the chest radiograph, and bedside spirometry shows a decrease in FVC of 50% from the pre-operative value. Furthermore, coronary artery bypass surgery is a well-known risk factor for phrenic nerve injury. Patients with unilateral diaphragmatic paralysis are usually asymptomatic but may have dyspnoea on exertion and limited exercise capacity. Coexisting conditions such as obesity, weakness of other muscle groups or underlying heart and lung disease (*e.g.* COPD) may worsen dyspnoea in patients with unilateral diaphragmatic paralysis, especially when they are supine. A lateral decubitus radiograph may differentiate pleural effusion from elevation of the diaphragm. But fluoroscopy of the diaphragm with sniff test is more useful to evaluate diaphragmatic function. Because of the absence of pulmonary infiltrates or pleural change in the radiograph, no other imaging tests seem necessary.

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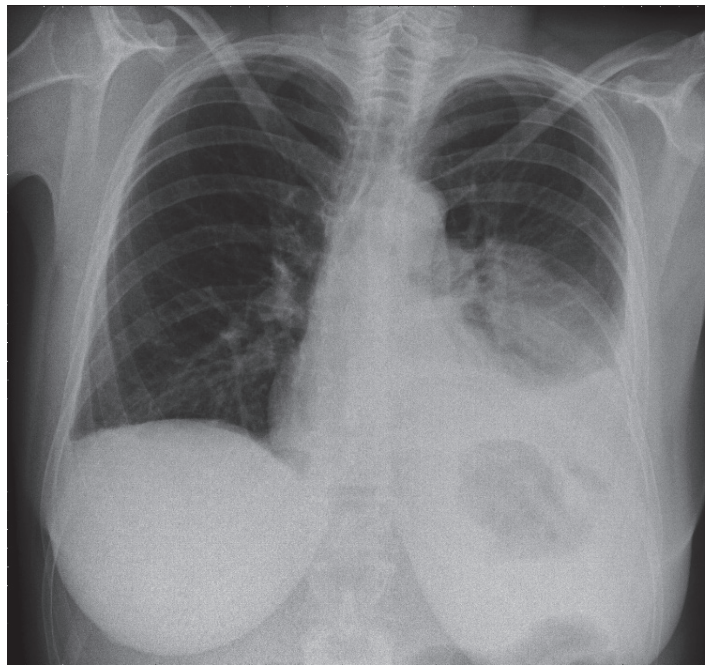
McCool FD, *et al.* Dysfunction of the diaphragm. *N Engl J Med* 2012; 366: 932–942.

HERMES Syllabus link: 9 Thoracic tumours, 20 Pleural diseases, 27 Associated specialties
Angoff rating: 62%

Question 202

A 45-year-old woman presents to the office with a 3-week history of mild shortness of breath. She does not drink or smoke. She had generally been in good health until she began losing weight 2 months ago. Her family history is unremarkable. She is afebrile, and her chest examination reveals dullness and decreased breath sounds at the left base. Her abdomen is not tender and has normal bowel sounds. The results of laboratory studies and her chest radiograph are shown below.

Peripheral blood		**Thoracocentesis**	
Haematocrit %	37	**Cells per μL**	980
Leukocytes per μL	8700	**Lymphocytes %**	70
Neutrophils %	67	**Neutrophils %**	20
Lymphocytes %	20	**Mesothelial cells %**	1
Monocytes %	10	**Protein g·L^{-1}**	4.3
Eosinophils %	3	**Lactate dehydrogenase U·L^{-1}**	300
Serum protein g·L^{-1}	6.2	**Glucose mmol·L^{-1}**	3.4
Serum lactate dehydrogenase U·L^{-1}	210	**Pleural fluid pH**	7.37
Serum glucose mmol·L^{-1}	3.9	**Cytology**	No malignant cells



Which of the following is the most likely explanation for the effusion?

a. Small oesophageal rupture
b. Pancreatitis
c. Meigs' syndrome
d. Mesothelioma
e. Tuberculous pleurisy

Correct answer

e. Tuberculous pleurisy

The most likely diagnosis is tuberculous pleurisy. Effusions in tuberculous pleurisy are mostly exudative, lymphocytic and contain few mesothelial cells. Their glucose concentration is >3.4 mmol·L^{-1} in 80–85% of cases. Pleural fluid glucose is <1.7 mmol·L^{-1} in ~15% of cases. Pleural fluid pH is usually 7.30–7.40 (rarely ever >7.40), although it can be <7.30 in ~20% of cases.
pH would be low in an oesophageal rupture due to gastric acid. Oesophageal rupture causes severe mediastinitis and pleuritis, such that the pleural fluid contains high numbers of leukocytes with neutrophilic predominance.
Pancreatitis causes extensive tissue destruction; therefore, the corresponding pleural effusions contain high levels of lactate dehydrogenase (LDH) and amylase from the necrotic tissue of the pancreas.
Meigs' syndrome, which is a combination of an ovarian fibroma or granulosa cell tumour with ascites and pleural effusion, is unlikely because this patient's abdomen is unremarkable and seems not to contain ascites. Pleural effusions in Meigs' syndrome are exudative and have a low white blood cell count.
Mesothelioma is unlikely because of the low LDH, the normal glucose and the lack of malignant cells in the pleural fluid. In one third of patients with pleural effusion due to mesothelioma, the pH is <7.2 and the glucose is <2.8 mmol·L^{-1} in the pleural fluid.

References

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Loddenkemper R. Pleural effusion. *In:* Palange P, *et al.*, eds. *ERS Handbook of Respiratory Medicine.* 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 428–431.

HERMES Syllabus link: 8 Mycobacterial diseases, 20 Pleural diseases
Angoff rating: 56%

Question 203

A 58-year-old obese patient (BMI 39.6 $kg \cdot m^{-2}$) complains of new-onset of daytime fatigue and early morning headache. His wife reports that he snores heavily. The patient had an inferior wall myocardial infarction 2 years ago. His cardiologist reported normal systolic cardiac function but grade I diastolic dysfunction 1 month ago. The patient is a lifetime nonsmoker. His past medical history is unremarkable. A nocturnal pulse oximetry reveals an oxygen desaturation index (>3%) of 68 events per h. His daytime arterial blood gas analysis shows a P_{aO_2} of 8.8 kPa (66 mmHg), a P_{aCO_2} of 7.8 kPa (58.5 mmHg), an S_{pO_2} of 93%, a pH of 7.38 and a bicarbonate level of 27 $mmol \cdot L^{-1}$. What is the most likely diagnosis?

a. Complex sleep apnoea syndrome
b. Mixed central and OSAS
c. Cheyne–Stokes respiration syndrome
d. Idiopathic central alveolar hypoventilation syndrome
e. Obesity hypoventilation syndrome

Correct answer

e. Obesity hypoventilation syndrome

Obesity hypoventilation syndrome best fits the description of this patient. The syndrome is defined as daytime hypercapnia and obesity with no other explanation for hypercapnia. The patient in the question showed daytime hypercapnia that was not otherwise explained, as no respiratory diseases are mentioned.

Patients with complex sleep apnoea have obstructive sleep apnoea but central sleep apnoea becomes dominant when the obstructive part is successfully treated. The clinical relevance of this syndrome is still a matter of debate, as after prolongation of CPAP therapy, this phenomenon may disappear. However, persistent residual central sleep apnoea may disturb sleep quality, prevent complete symptomatic improvement and may lead to CPAP intolerance.

OSAS is not associated with daytime hypercapnia; occasionally, it may lead to nocturnal increase of carbon dioxide. OSAS is characterised by recurrent episodes of partial or complete upper airway collapse during sleep. According to the definition of the American Academy of Sleep Medicine, apnoea/hypopnoea events last for >10 s and are characterised by >50% decrease from baseline breathing amplitude during sleep with an oxygen desaturation ≥3% or an arousal. Alternatively, a 30% reduction in breathing amplitude with an oxygen desaturation >3% also defines a hypopnoea. Cheyne–Stokes respiration typically occurs in patients with congestive heart failure or ischaemic stroke. Risk factors are age >60 years, male sex, severe heart failure, hypocapnia and atrial fibrillation.

Central sleep apnoea/hypopnoea (CSA) results from the reduction in ventilation due to transient loss or reduction of neural output to the respiratory muscles. Idiopathic CSA syndrome is, by definition, not associated with any underlying disease. CSA causes sleep fragmentation, which may be perceived as unrefreshing sleep and may result in daytime sleepiness. Idiopathic CSA is thought to be much less common than OSAS, although no systematic epidemiological studies have been performed.

Sleep-induced hypoventilation is characterised by increased P_{aCO_2} levels of >6 kPa (>45 mmHg). It is associated with decreased ventilatory drive, respiratory iatrogenic depression, alteration of respiratory nerve conductance, respiratory muscle weakness, chest-wall deformities or severe obesity.

References

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White DP. Pathogenesis of obstructive and central apnea. *Am J Respir Crit Care Med* 2005; 172: 1363–1370.

HERMES Syllabus link: 18 Respiratory failure, 22 Sleep and control of breathing disorders
Angoff rating: 59%

Question 204

Which of the following statements about oxygen saturation measured by pulse oximetry is/are correct?

a. Oxygen saturation is underestimated in mild anaemia.
b. Oxygen saturation is influenced by pH but not by temperature.
c. An oxygen saturation of >94% is a surrogate for adequate tissue oxygenation.
d. Carboxyhaemoglobin reduces saturation measured by pulse oximetry.

Correct answer

None of the answers is correct.

The pulse oximeter has become an essential tool in the modern practice of emergency medicine. However, knowledge of its underlying principles and associated limitations are essential for appropriate clinical use. For example, hypoxaemia during severe carbon monoxide intoxication is missed by pulse oximetry due to the absorption of red light by carboxyhaemoglobin instead of oxyhaemoglobin. Methaemoglobinaemia is not detectable with pulse oximeters. Anaemia does not interfere with accuracy unless it is very severe (Hb <50 $g \cdot L^{-1}$). Tissue oxygenation is not assessed by pulse oximetry, as S_{pO_2} does not account for oxygen carriers and tissue delivery. Thus, in severe anaemia or hypoperfusion, tissue oxygenation may be inappropriate even with a normal S_{pO_2}.

P_{aO_2} and oxygen saturation do not correlate linearly. In the higher range of P_{aO_2}, there is a flat portion of the curve where a reduction of P_{aO_2} down to around 8 kPa (60 mmHg) only marginally affects saturation. At lower P_{aO_2}, saturation drops steeply. Acidosis, elevated body temperature and 2,3-diphosphoglycerate move the dissociation curve to the right; thus, oxygen is more easily released from Hb and, thereby, enhances tissue oxygenation.

References

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Sinex JE. Pulse oximetry: principles and limitations. *Am J Emerg Med* 2004; 17: 59–67.

Thurnheer R, *et al.* Pulsoximetrie [Pulse oximetry]. *Schweiz Med Forum* 2004; 4: 1218–1223.

HERMES Syllabus link: 4 Other diagnostic procedures, 22 Sleep and control of breathing disorders
Angoff rating: 55%

Question 205

A 35-year-old builder presents with a 10-year history of progressively worsening daytime sleepiness and disruptive snoring. He now falls asleep several times a day whenever he is inactive, such as while watching television, and even during work breaks and whilst waiting for lunch to be served in a restaurant. He is concerned about losing his job. He is a lifetime nonsmoker. He jogs 2–3 km daily without difficulty. His past history and a review of his symptoms are otherwise unremarkable. He is 180 cm tall, weighs 91 kg and has a neck circumference of 47.5 cm. Physical examination is otherwise normal. Polysomnography reveals 62 obstructive apnoeas/hypopnoeas per hour (AHI 62 events per h), mostly associated with oxygen desaturations to 70–79%; sometimes, his S_{pO_2} is <70%. His waking oxygen saturation is 94%. You recommend CPAP therapy for this patient but he is not convinced.
If he decides against CPAP, which of the following is the most important risk that you should explain to him?

a. Increased nocturnal mortality
b. Right heart failure, daytime respiratory failure and/or erythrocytosis
c. Systemic hypertension
d. Reduced performance IQ, decreased memory and reduced manual dexterity
e. Increased motor vehicle and industrial accidents

Correct answer

e. Increased motor vehicle and industrial accidents

This patient is suffering from OSAS. Right heart failure, respiratory failure and secondary erythrocytosis are not typical features of OSAS but of the obesity hypoventilation syndrome, which is characterised by alveolar hypoventilation with daytime hypercapnia and hypoxaemia. During the daytime, this patient has a normal oxygen saturation of 94%.
OSAS is associated with increased mortality primarily because of lethal accidents caused by daytime sleepiness, so either a motor vehicle accident or, as the patient is a builder, a work-associated accident poses by far the highest risk for him. In this young, otherwise healthy man, OSAS-associated mortality through cardiovascular morbidity due to hypertension and metabolic disturbances, such as decreased insulin sensitivity and hyperlipidaemia, is much lower than the hazard of falling asleep at work or behind the wheel.
The lack of stage III and IV sleep in OSAS, and nocturnal hypoxaemia, are factors that can cause memory and neurobehavioural problems.

Reference

Simon S, *et al*. Latest advances in sleep medicine: obstructive sleep apnea. *Chest* 2012; 142: 1645–1651.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 65%

Question 206

Which of the following factors does not influence T_{LCO} measured by the single-breath method?

a. Polycythaemia vera
b. Lung haemorrhage
c. Tobacco smoking
d. Ventilation–perfusion inequality
e. Tracheostomy

Correct answer

e. Tracheostomy

*T*LCO measures the ability of the lungs to transfer gas from inhaled air to red blood cells in the pulmonary capillaries. It is measured by inhaling the tracer gas carbon monoxide. *T*LCO will be increased by high Hb levels (polycythaemia) and by red blood cells in the alveolar space following haemorrhage, as these enhance carbon monoxide uptake. *T*LCO is reduced in smoking-related lung damage and ventilation–perfusion mismatch. A tracheostomy will reduce upper airway deadspace but does not influence *T*LCO.

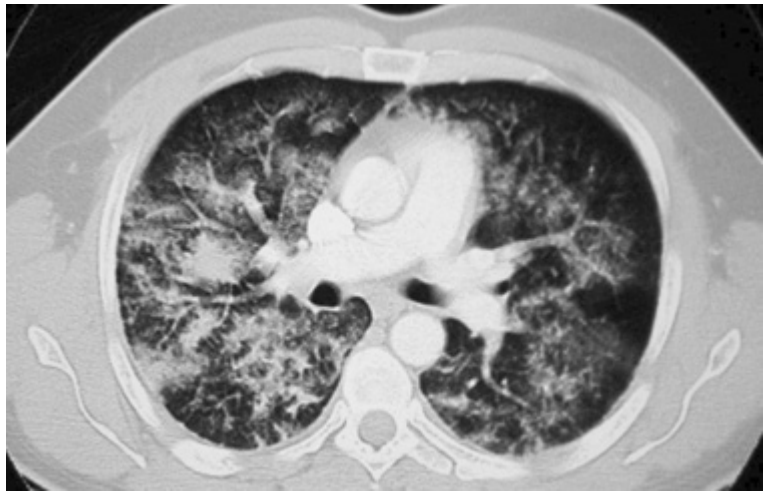
Reference

Hughes JM. Gas transfer: *T*LCO and *T*LNO. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 77–81.

HERMES Syllabus link: 3 Pulmonary function testing
Angoff rating: 70%

Question 207

A 45-year-old man is admitted to the hospital due to recurrent haematemesis and syncopal episodes. He has a history of gastric and duodenal ulcers but no other serious diseases. Gastroscopy reveals a gastric ulcer with no active bleeding. Lab results show severe anaemia with a Hb concentration of 44 $g \cdot L^{-1}$. Coagulation tests are normal. He receives 9 units packed red blood cells and 6 units fresh frozen plasma. The total amount of fluid replaced is 6.3 L in 9 h. During transfusion of the last two units of packed red blood cells, the patient becomes severely dyspnoeic, febrile (39ºC) and hypoxaemic (oxygen saturation on 4 L oxygen by nasal cannula 88%). An echocardiogram shows normal left ventricular function but the pulmonary arterial pressure is elevated (systolic transtricuspid pressure gradient 50 mmHg), and the right atrium and ventricle are dilated. A CT angiogram of the chest rules out pulmonary emboli but reveals diffuse infiltrates (see below).



What is most likely the cause of this disease?

a. Volume overload
b. Decompensated cor pulmonale due to volume overload
c. Activation of granulocytes by transfused biologically active substances
d. Transfusion-associated systemic infection
e. Diffuse alveolar haemorrhage secondary to coagulopathy after high-volume transfusion

Correct answer

c. Activation of granulocytes by transfused biologically active substances

Acute transfusion reactions present within 24 h of a blood transfusion. Acute transfusion reactions are typically classified as:

- Transfusion-related acute lung injury (TRALI)
- Circulatory (volume) overload
- Endotoxaemia through bacterial contamination
- Acute haemolytic reactions
- Nonhaemolytic febrile reactions
- Allergic reactions

The case presented here fulfils the diagnostic criteria of TRALI, as established from a group of experts during the American–European Consensus Conference in 2004 (table). The main symptom of TRALI is dyspnoea, which often co-occurs with tachypnoea, tachycardia, cyanosis and frothy pulmonary secretions. Fever, hypotension or hypertension is also reported. Major difficulty remains in differentiating TRALI from transfusion-associated volume overload. The clinical picture of transfusion-associated volume overload resembles that of cardiogenic pulmonary oedema. Apart from dyspnoea and tachypnoea, the features of volume overload are jugular venous distension, S3 gallop and high systolic blood pressure, with evidence of left atrial hypertension.

Table Diagnostic criteria of TRALI

Acute lung injury
Acute onset of symptoms
Hypoxaemia: PaO_2/FIO_2 <40.0 kPa (<300 mmHg) or SpO_2 <90% without supplemental oxygen
Bilateral infiltrates on chest imaging
No evidence of increased left atrial pressure
No pre-existing acute lung injury before transfusion
Development of symptoms within 6 h of transfusion
No temporal association with alternative risk factors for acute lung injury (foreign body aspiration, pneumonia, inhalation of toxins, burns, drowning, polytrauma, drug overdose, acute pancreatitis or cardiopulmonary bypass)

FIO_2: inspiratory oxygen fraction.

The main cells involved in TRALI pathogenesis are neutrophils. Transfused human leukocyte or neutrophil antigen antibodies and transfused bioactive substances such as lipids or cytokines lead to activation and sequestration of neutrophils, which damage the endothelial barrier.

When symptoms of acute respiratory distress occur during transfusion, the procedure should immediately be discontinued and not resumed even if the symptoms diminish. Treatment of TRALI is symptomatic and based on oxygen therapy. Approximately 70% of patients require intubation and mechanical ventilation. In the absence of signs of acute volume overload or cardiogenic pulmonary oedema, diuretics are not indicated. There is also no evidence that corticosteroids or antihistamines are beneficial.

References

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Kleinman S, *et al.* Toward an understanding of transfusion-related acute lung injury: statement of a consensus panel. *Transfusion* 2004; 44: 1774–1789.

Vlaar AP, *et al.* Transfusion-related acute lung injury: a clinical review. *Lancet* 2013; 382: 984–994.

HERMES Syllabus link: 13 Respiratory consequences of systemic/ extrapulmonary disorders, 18 Respiratory failure
Angoff rating: 55%

Question 208

A 28-year-old, schizophrenic, unemployed man is referred to you for evaluation of an abnormal chest radiograph and CT. The patient has a 3-month history of chest pain and nonproductive cough with 4 kg weight loss. The chest radiograph shows an anterior mediastinal mass. This mass is confirmed by chest CT showing probable involvement of the anterior chest wall. CT of the chest and abdomen is otherwise unremarkable. The physical examination is normal. The patient refuses any invasive procedures.
Which noninvasive test might be of value in confirming a diagnosis?

a. MRI of the chest
b. Bone scan
c. α-fetoprotein and β-subunit of human chorionic gonadotropin assay
d. Ultrasound of the testes
e. Iodine-135 radioisotope uptake scan of the thyroid

Correct answer

c. α-fetoprotein and β-subunit of human chorionic gonadotropin assay

Thymoma is the most common primary neoplasm of the anterior mediastinum but its incidence is greater during the fourth and fifth decades of life. Other malignancies of the anterior mediastinum include mediastinal germ cell tumours (teratomas, and seminomatous and nonseminomatous tumours). The great majority of mediastinal malignant germ cell tumours occur in patients between 20 and 35 years of age. A diagnosis of a mediastinal germ cell tumour should be considered in all young males with a mediastinal mass. In addition to physical examination and routine laboratory studies, initial evaluation should include CT of the chest and abdomen, and determination of serum levels of human chorionic gonadotropin and α-fetoprotein. Anterior mediastinal mass imaging is predominantly carried out by CT. In selected cases, there is a role for MRI. Iodine-125 radioisotope uptake scanning of the thyroid can be useful in cases of a suspected thyroid neoplasm. In the described case, the CT of abdomen is negative, so we could exclude a testis seminoma. A bone scan could be performed for staging but would not provide information on the type of neoplasm.

References

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Kufe DW, *et al.*, eds. Holland-Frei Cancer Medicine. 6nd Edn. Hamilton, BC Decker, 2003.

Schmoll HJ, *et al.* European consensus on diagnosis and treatment of germ cell cancer: a report of the European Germ Cell Cancer Consensus Group (EGCCCG). *Ann Oncol* 2004; 15: 1377–1399.

HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 59%

Question 209

A 69-year-old male, with a history of smoking and asbestos exposure between the ages of 30 and 55 years, complains of right-sided chest pain, breathlessness on exertion and cough. A chest radiograph shows a right pleural effusion associated with nodular pleural thickening. Thoracentesis shows a bloody coloured pleural effusion with a cytological suspicion of mesothelioma.
Which of the following statements is/are true for this patient?

a. Thoracoscopy is the preferred diagnostic procedure.
b. Thoracentesis may cause spread of the tumour into the chest wall.
c. The patient's tobacco use has played a significant role in the development of mesothelioma.
d. Calretinin and Wilms tumour antigen-1 are two immunohistochemical markers with diagnostic value for mesothelioma.

Correct answers

a. Thoracoscopy is the preferred diagnostic procedure.
b. Thoracentesis may cause spread of the tumour into the chest wall.
d. Calretinin and Wilms tumour antigen-1 are two immunohistochemical markers with diagnostic value for mesothelioma.

Previously considered to be rare, malignant pleural mesothelioma (MPM) is a highly aggressive tumour that has become a very important issue over recent years. The disease is associated with asbestos exposure and its incidence will continue to increase for some years to come even in regions where the commercial use of asbestos has been banned. It is certain to continue to contribute to cancer mortality in regions of the world lacking worker protection and persisting with its commercial use. Agents other than asbestos are considered to be recognised as potential risk factors or cofactors for MPM, namely exposure to other natural or man-made (refractory ceramic) fibres, ionising radiation and SV40 virus. It is known that tobacco does not play a role in the development of mesothelioma, as tobacco smoking is not carcinogenic to the pleura.
The clinical manifestations of MPM are usually nonspecific and insidious and should not be used alone as diagnostic criteria, even in case of previous asbestos exposure. A chest CT scan is unsuitable for definitive diagnosis of MPM, but diffuse or nodular pleural thickening is suggestive of the disease. The accurate diagnosis of mesothelioma is made on histopathological examination. It is not recommended to make a diagnosis of mesothelioma based on cytology alone because of the high risk of diagnostic error. So, a cytological suspicion of mesothelioma must be followed by tissue confirmation. Thoracoscopy is preferred for diagnostic investigation, allowing complete visual examination of the pleura, deep and large biopsies and providing a diagnosis in more than 90% of cases. Mesothelioma may spread into the chest wall at the site of thoracentesis.
A complementary immunohistochemical examination must be carried out in addition to morphological examination for the diagnosis of MPM. Markers with positive diagnostic value for mesothelioma are nuclear markers such as calretinin and Wilms tumour antigen-1 (WT-1) or the membrane marker anti-epithelial membrane antigen (EMA) and cytokeratin (CK5/6).

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HERMES Syllabus link: 9 Thoracic tumours, 20 Pleural diseases, 27 Associated specialties
Angoff rating: 50%

Question 210

Which of the following test results will most reliably differentiate between asthma and emphysema?

a. A positive methacholine challenge
b. Post-bronchodilator spirometry improvement of 10%
c. FEV_1 60% of predicted
d. A reduced T_{LCO}
e. An increased TLC

Correct answer

d. A reduced *T*LCO

Airway hyperresponsiveness with a positive methacholine challenge and post-bronchodilator spirometry improvement of 10% can be found in both asthma and COPD with emphysema. Confirmation of a positive bronchodilator reversibility test as one of the characteristics of asthma requires >12% improvement and >200 mL increase in FEV1. An FEV1 of 60% predicted or, in fact, any value can be measured in both asthma and emphysema, and even in restrictive lung and chest wall disease. Lung hyperinflation with increased TLC and decreased FEV1 (airflow obstruction) can be a finding in both of asthma and emphysema. *T*LCO is normal or increased in asthma but is usually low in emphysema.

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HERMES Syllabus link: 6 Airway diseases
Angoff rating: 67%

Question 211

A 25-year-old female has suffered severe peripartum bleeding. She received 20 packed red blood cell transfusions and five fresh frozen plasma transfusions. After delivery, she had to be intubated and was placed on mechanical ventilation for respiratory failure. She is deeply sedated but occasionally triggers the ventilator. On the third day of mechanical ventilation, her arterial blood gas analysis shows a P_{aO_2} of 6.7 kPa (50 mmHg), P_{aCO_2} of 6.3 kPa (47 mmHg) and pH of 7.33. The ventilator settings are: inspiratory oxygen fraction (F_{IO_2}) 0.8; assist control with tidal volume 420 mL and frequency 18 breaths per min; inspiratory time (t_I)/expiratory time (t_E) ratio 1/3; and positive end-expiratory pressure (PEEP) 10 cmH_2O. Plateau pressure is 32 cmH_2O. She weighs 60 kg. Chest radiography reveals bilateral diffuse pulmonary infiltrates.
What would be the most appropriate change in the ventilator settings for this patient?

a. Switch to pressure-control ventilation.
b. Decrease PEEP to 8 cmH_2O.
c. Decrease tidal volume to 360 mL.
d. Switch to inverse ratio ventilation (t_I/t_E 2/1).
e. Decrease ventilator frequency to 15 breaths per min.

Correct answer

c. Decrease tidal volume to 360 mL.

The patient suffers from acute respiratory distress syndrome (ARDS). This is defined by: bilateral opacities unexplained by nodules, atelectasis or effusion, on chest radiography or CT; new or worsening respiratory symptoms, or a clinical insult associated with ARDS within 7 days of diagnosis; objective assessment of cardiac function (*e.g.* by echocardiography) to exclude cardiogenic pulmonary oedema; and hypoxaemia, with a P_{aO_2}/F_{IO_2} ratio ≤40.0 kPa (≤300 mmHg) despite NIV or invasive mechanical ventilation with PEEP or CPAP ≥5 cmH_2O. She should be ventilated using a lung-protective strategy that encompasses volume-controlled ventilation with a tidal volume of 4–8 $mL \cdot kg^{-1}$ of ideal body weight, a plateau pressure <30 cmH_2O and a modest level of PEEP. The lung-protective strategy has been shown to decrease mortality in patients with ARDS while pressure-control ventilation and inverse-ratio ventilation are not known to improve outcome in ARDS.
By decreasing tidal volume to 360 mL, the plateau pressure will also decrease, while decreasing the PEEP will probably deteriorate oxygenation. By decreasing the ventilator frequency, the patient will probably increase their triggering of the ventilator.

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HERMES Syllabus link: 5 Treatment modalities and prevention measures, 18 Respiratory failure, 23 Pregnancy
Angoff rating: 48%

Question 212

An otherwise healthy 32-year-old woman, who is an employee in a nursing home, is given a tuberculin skin test (TST). Her reaction is a 2-mm induration. 2 weeks later, on repeat testing, her reaction is 4 mm. 14 months later, a person in the home is diagnosed as having pulmonary tuberculosis. The TST of the still asymptomatic employee is repeated and shows 22 mm induration at 48 h; an interferon-γ release assay is positive. Posteroanterior and lateral chest radiographs show no abnormalities.
What should be recommended?

a. Careful observation with sequential chest radiograph and clinical evaluation every 3 months for the next year
b. Observation for 3 months and then repetition of the skin test
c. Three sputum samples should be cultured for mycobacteria: if the results are negative, start treatment with isoniazid 300 mg daily for 1 year; if the results are positive, give standard treatment for pulmonary tuberculosis
d. Three sputum samples should be cultured for mycobacteria and then the patient should be treated with isoniazid 300 mg and rifampicin 600 mg daily for 6 months
e. Treatment with isoniazid 300 mg daily for 6–9 months

Correct answer

e. Treatment with isoniazid 300 mg daily for 6–9 months

This asymptomatic employee of a nursing home has all the features of latent tuberculosis. Her TST has converted after exposure to a patient with pulmonary tuberculosis; the positive interferon-γ release assay confirms the TST. Her chest radiograph does not show signs of active tuberculosis. Treatment of persons under the age of 45 years consists of monotherapy with isoniazid for 6–9 months (table). This aims to prevent later occurrence of active tuberculosis. Without preventive therapy, the life-time risk of progression from latent to active tuberculosis is 5–10% for this healthy woman.

Table Treatment of latent tuberculosis (TB) infection

Treatment of latent TB infection should be considered for people in the following groups, once active TB has been excluded by chest radiography and examination
People identified through screening who are:
35 years or younger (because of increasing risk of hepatotoxicity with age)
Any age with HIV
Any age and a healthcare worker
And are either:
Mantoux positive (≥6 mm) and without prior BCG vaccination, or
Strongly Mantoux positive (≥15 mm), interferon-γ positive and with prior BCG vaccination
Children aged 1–15 years identified through opportunistic screening to be:
Strongly Mantoux positive (≥15 mm), and
Interferon-γ positive (if this test has been performed), and without prior BCG vaccination
People with evidence of TB scars on chest radiography and without a history of adequate treatment
People with HIV who are in close contact with people with sputum smear-positive respiratory TB should have active disease excluded and then be given treatment for latent TB infection
Treatment for latent TB infection should not be started in close contacts of people with sputum smear-positive MDR-TB who are strongly Mantoux positive (≥15 mm), as no regimen is of proven benefit and only a small proportion of people infected will develop the disease; long-term monitoring should be undertaken for active disease
People who have agreed to receive treatment for latent TB infection should be started on one of the following regimens
Either 6 months of isoniazid (6H) or 3 months of rifampicin and isoniazid (3RH) for people aged 16–35 years not known to have HIV
Either 6H or 3RH for people older than 35 years in whom treatment for latent TB infection is recommended and who are not known to have HIV
6H for people of any age who have HIV
6R for contacts aged ≤35 years of people with isoniazid-resistant TB
People eligible for treatment of latent TB infection but who decline to take this treatment should be given 'inform and advise' information about TB and have chest radiography 3 and 12 months later

BCG: bacille Calmette–Guérin; MDR: multidrug-resistant. Reproduced and modified from National Institute for Health and Care Excellence (2011).

As all criteria for latent tuberculosis are fulfilled, no further observation, tests or radiographs are indicated. Sputum cultures will not grow mycobacteria in latent tuberculosis; positive cultures are a feature of active tuberculosis.

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HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 66%

Question 213

A 46-year-old, nonsmoking female patient with no previous disease history is admitted to your ward with a 2-week history of persistent cough and haemoptysis, and progressive exercise dyspnoea. She reports no fever or upper respiratory symptoms. Physical examination shows normal vital signs with a S_{pO_2} of 92% in ambient air and scattered bilateral crackles on lung auscultation. The chest radiograph reveals patchy bilateral alveolar consolidation confirmed by CT. Lung function tests show a mild restrictive pattern with a T_{LCO} of 110% predicted. Laboratory investigation shows mild anaemia (Hb 10.5 $g{\cdot}dL^{-1}$), a normal white blood cell count and differential cell count, haematuria, and proteinuria. Bronchoalveolar lavage confirms alveolar haemorrhage.
Which of the following diagnoses would a positive myeloperoxidase anti-neutrophil cytoplasmic antibody test favour?

a. Granulomatosis with polyangiitis
b. Eosinophilic granulomatosis with polyangiitis (Churg–Strauss syndrome)
c. Microscopic polyangiitis
d. Pulmonary haemosiderosis
e. Polyarteritis nodosa

Correct answer

c. Microscopic polyangiitis

This patient has alveolar haemorrhage and glomerulonephritis. Except for pulmonary haemosiderosis (which is limited to the lung), all of the diagnoses are vasculitides that may present with this combination of features (although polyarteritis nodosa rarely involves the lung). A positive anti-neutrophil cytoplasmic antibody (ANCA) test (either myeloperoxidase (MPO) or proteinase-3 (PR3)) is a strong argument against polyarteritis nodosa. The presence of MPO-ANCA or PR3-ANCA is variable among different ANCA-associated vasculitides (table). The absence of asthmatic features and of eosinophilia in our patient makes eosinophilic granulomatosis with polyangiitis less likely. The presence of MPO-ANCA is more frequently associated with microscopic polyangiitis and of PR3-ANCA is more frequently associated with granulomatosis with polyangiitis. Although the clinical presentation and ANCA type might be highly suggestive of a specific type of ANCA-associated vasculitis, renal or lung biopsy is frequently needed in order to confirm the diagnosis.

Table Are ANCAs present in all patients with ANCA-associated vasculitis?

Diagnosis	Patients n	PR3-ANCA	MPO-ANCA	Elastase-ANCA	No ANCA detected	Patients with ANCA %
GPA	364	323	25	4	12[#]	96
EGPA	36	0	23	0	13	64
MPA	85	16	67	1	1	98
NCGN	54	4	47	1	2	94

GPA: granulomatosis with polyangiitis; EGPA: eosinophilic granulomatosis with polyangiitis; MPA: microscopic polyangiitis; NCGN: necrotising and crescentic glomerulonephritis. [#]: 10 out of 12 cases were ENT limited. Reproduced and modified from Kallenberg *et al.* (2014) with permission from the publisher.

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HERMES Syllabus link: 12 Eosinophilic diseases, 13 Respiratory consequences of systemic/extrapulmonary disorders, 14 Pulmonary vascular diseases
Angoff rating: 56%

Question 214

A 75-year-old male complains about increasing dyspnoea on exertion. The patient worked with building insulation for many years. 10 years ago, he suffered a myocardial infarction. Percussion reveals dullness of the right lower chest; auscultation reveals diminished breath sounds over the area of dullness. Chest radiography and ultrasound show a medium-sized pleural effusion, and this is confirmed by a CT scan, which also shows enlarged mediastinal lymph nodes. Medical thoracoscopy demonstrates a diffuse malignant mesothelioma on both pleural layers with infiltration of the pericardium. An endobronchial ultrasound-guided lymph node biopsy revealed bilateral infiltrated lymph nodes. Immune histology reveals a biphasic cell type.
Which one of the following is the best treatment option?

a. Extrapleural pneumonectomy
b. Debulking surgery (pleurectomy/decortication)
c. Radiotherapy of the hemithorax
d. Chemotherapy with pemetrexed/cisplatin
e. Indwelling pleural catheter

Correct answer

d. Chemotherapy with pemetrexed/cisplatin

Combined chemotherapy with an antimetabolite (*e.g.* pemetrexed) and cisplatin offers the best treatment option in patients with a good performance score. Surgery is indicated in only a few selected cases. Because it is T3N3, this is a stage IV mesothelioma and, therefore, does not warrant an operative approach. Irradiation of the complete hemithorax has been used only in a multimodal treatment approach combined with extrapleural pneumonectomy. An indwelling pleural catheter would be indicated for removal of pleural fluid. If the combined chemotherapy is not successful, the treatment of choice for recurring pleural effusion would be pleurodesis. An alternative approach could be thoracoscopic talc poudrage, followed by combined chemotherapy.

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HERMES Syllabus link: 5 Treatment modalities and prevention measures, 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 55%

Question 215

α_1-antitrypsin (α_1-AT) deficiency (PiZZ) is detected in a 65-year-old nonsmoker with mild COPD (FEV_1 82% predicted).
When counselling the patient, which of the following is/are correct?

a. His life expectancy is almost normal.
b. His risk of liver cirrhosis is increased.
c. His risk of adenocarcinoma of the lung is increased.
d. The chance of other cases of α_1-AT deficiency among his relatives is increased.

Correct answers

a. His life expectancy is almost normal.
b. His risk of liver cirrhosis is increased.
d. The chance of other cases of α_1-AT deficiency among his relatives is increased.

Low FEV1 is the major risk factor for death in α_1-AT-deficient patients. This patient has an almost normal FEV1, and is a nonsmoker and 65 years old, so his life expectancy is almost normal. The chance of liver cirrhosis is increased in α_1-AT-deficient patients but that of lung adenocarcinoma is not. Siblings of α_1-AT-deficient patients have a 25% chance of α_1-AT deficiency while children have a 1% chance.

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HERMES Syllabus link: 6 Airway diseases, 26 Genetic and developmental disorders
Angoff rating: 58%

Question 216

A 24-year-old woman in her 24th week of pregnancy is seen in the emergency department complaining of sudden onset of shortness of breath, nonproductive cough and sharp pain over the left lower chest. On examination, there are crackles at the base of the left lung. Her left calf is tender and slightly warm. Her arterial blood gas results are P_{aO_2} 10.8 kPa (81 mmHg), P_{aCO_2} 4.5 kPa (34 mmHg) and pH 7.44. D-dimers are positive.
What is the first test you should ask for in this patient?

a. CT pulmonary angiography
b. Compression ultrasound of the lower limbs
c. Venography of the lower limbs
d. Ventilation–perfusion lung scanning
e. Conventional pulmonary angiography

Correct answer

b. Compression ultrasound of the lower limbs

Compression ultrasound of the lower limbs is the first-line diagnostic test that should be used in this pregnant woman with possible symptoms of deep vein thrombosis of her left calf because it is not associated with exposure to radiation. If the ultrasound examination is negative, chest radiography would be the next recommended test followed by ventilation/perfusion scintigraphy if the radiograph was normal (figure). If the scintigraphy is nondiagnostic, CT angiography is recommended. The use of D-dimer tests is discouraged in pregnant women because D-dimer level increases during normal pregnancy and, therefore, the specificity and sensitivity of D-dimer during pregnancy are only 15% and 73%, respectively.

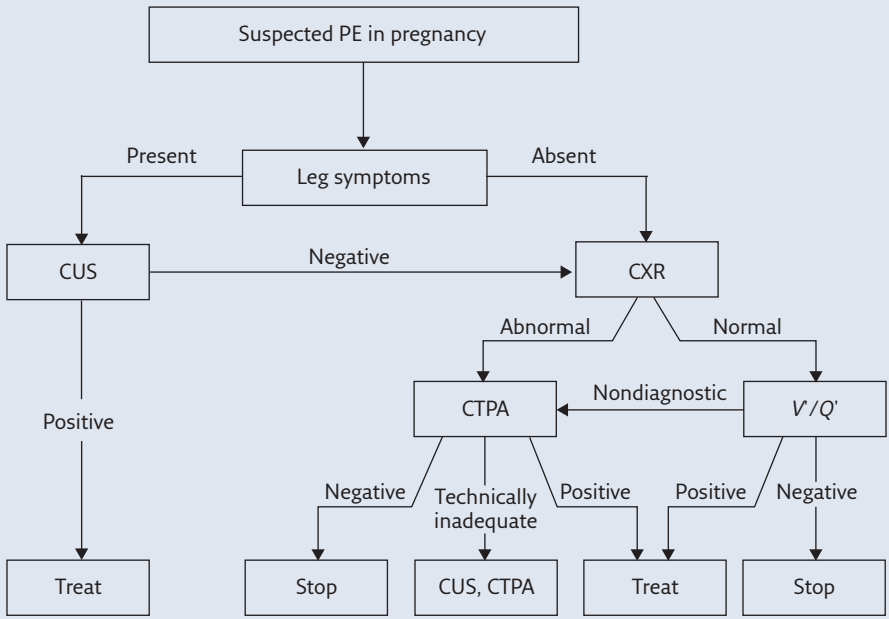

FIGURE. Diagnostic algorithm recommended by the American Thoracic Society and the Society of Thoracic Radiology. PE: pulmonary embolism; CUS: compression ultrasound; CXR: chest radiography; CTPA: CT pulmonary angiography; *V'/Q'*: ventilation/perfusion lung scanning. Reproduced from Leung *et al.* (2011) with permission from the publisher.

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HERMES Syllabus link: 14 Pulmonary vascular diseases, 23 Pregnancy
Angoff rating: 66%

Question 217

Which of the following statements concerning positional OSA is false?

a. If positional therapy is used for the treatment of OSA, follow-up sleep studies have to be performed.
b. Body position effects pharyngeal cross-sectional area and, thus, nocturnal respiratory disturbances.
c. Positional OSA is defined as a supine apnoea/hypopnoea of at least twice that in the lateral position.
d. Patients with positional OSA tend to have a lower AHI, be younger and be less obese than patients with nonpositional OSA.
e. Positional therapy is recommended as the first-line therapy for OSA.

Correct answer

e. Positional therapy is recommended as the first-line therapy for OSA.

The following effects of changes in body position have been described:

- changes in pharyngeal cross-sectional area;
- changes in pharyngeal closing pressure;
- changes in ventilatory drive; and thus,
- changes in sleep-related breathing disturbances.

Positional sleep apnoea is defined as a supine AHI of at least twice that in the lateral position. Using this definition, a prevalence of ~50% is reported. Patients with positional OSA tend to have a lower AHI, be younger and be less obese. Accordingly, patients with a clear improvement of the AHI with positional therapy tend to be younger, have a lower AHI and be less obese. Thus, they are an easy-to-treat subset of patients. Different devices such as a tennis ball, vests, a positional alarm, verbal instruction and pillows have had moderate effects on AHI in some studies. However, most studies were uncontrolled and small. Furthermore, long-term compliance was either poor or not evaluated. Thus, positional therapy is not recommended for the treatment of OSA. If positional therapy is used, follow-up sleep studies are strongly recommended.

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HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 80%

Question 218

A 35-year-old female is admitted to the emergency department with a history of repeated chest infections, diarrhoea, otitis media, pneumonia, lethargy and some weight loss. She has areas of vitiligo and a past history of haemolytic anaemia. Chest radiography shows bilateral mid-zone infiltrates. Pulmonary function tests show a mild restrictive ventilatory defect, with a reduced lung volume and T_{LCO}. A transbronchial lung biopsy shows a noncaseating granuloma.
Which one of the following options is the most likely diagnosis?

a. Sarcoidosis
b. Tuberculosis
c. Common variable immunodeficiency syndrome
d. Waldenström's macroglobulinaemia
e. Cryptococcosis

Correct answer

c. Common variable immunodeficiency syndrome

Common variable immunodeficiency (CVID) syndrome is characterised by a reduced level of immunoglobulins, which results in susceptibility to infections and autoimmune disorders. CVID may also be associated with noninfectious cutaneous granulomas, or visceral granulomas of the lungs, liver, spleen or conjunctiva. The cutaneous granulomas are nonspecific in patients with CVID, and can appear as a maculopapular rash, as infiltrated erythematous papules, plaques, excoriated papules and ulcers, or as nodules with ulcerations. On histological analysis, such granulomas are noncaseating and involve the dermis or subcutaneous fat.

The diagnosis of CVID should also be considered in patients with certain clinical features of sarcoidosis and noncaseating granulomas, who do not exhibit the characteristic hypogammaglobulinaemia and who have a history of recurrent infections. Although many features of sarcoidosis in patients with CVID are similar to those of patients with sarcoidosis alone, there are many important differences. Repeated infections, sinus infections, otitis, vitiligo and haemolytic anaemia are not symptoms of sarcoidosis. Thus, patients with CVID in whom sarcoid-type reactions develop present with hypogammaglobulinaemia rather than hypergammaglobulinaemia, and have a higher prevalence of recurrent infections, thrombocytopenia and splenic involvement. Infectious causes of noncaseating granulomas, including fungi, mycobacteria and certain other bacteria, always have to be considered and evaluated by microscopic and cultural examination. Waldenström's macroglobulinaemia is a lymphoma typically found in elderly patients with excessive production of IgM. Cryptococcosis is an important infection in immunosuppressed (HIV) patients. Meningoencephalitis is the most common presentation. Pulmonary *Cryptococcus* infection in immunocompetent patients is typically asymptomatic. Possible pulmonary symptoms include productive cough, haemoptysis and dyspnoea, in addition to fever, malaise, night sweats and weight loss.

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HERMES Syllabus link: 27 Associated specialties
Angoff rating: 39%

Question 219

A 45-year-old female presents to you with increasing cough and fatigue for the past 4 months. She is a heavy smoker (40 cigarettes per day for 25 years), with a medical history of diabetes and hypertension. A chest radiograph shows a left upper lobe mass, para-aortic mediastinal lymphadenopathy and ipsilateral pleural effusion. These findings were confirmed on chest CT. Fibreoptic bronchoscopy with tumour biopsy confirmed the diagnosis of small cell lung cancer (SCLC). Pleural fluid cytological examination after thoracentesis was also positive for SCLC. Additional workup with upper abdomen and head CT were negative for metastasis. Her performance status on the ECOG scale was 0 (fully active, without restrictions).
Which one of the following statements for this patient is false?

a. Chemotherapy with platinum/etoposide given for four to six cycles is the treatment of choice.
b. The patient has extensive disease due to malignant pleural effusion.
c. Her younger age, good performance status and single metastatic site are favourable prognostic factors.
d. Prophylactic cranial irradiation is recommended for this patient, after a complete response in the re-evaluation after 4 cycles of chemotherapy.
e. Concurrent chemoradiation (platinum/etoposide and concurrent thoracic radiotherapy) is an alternative treatment choice for this patient.

Correct answer

e. Concurrent chemoradiation (platinum/etoposide and concurrent thoracic radiotherapy) is an alternative treatment choice for this patient.

Small cell lung cancer (SCLC) accounts for 13–20% of all lung cancer cases. SCLC shares a strong association with tobacco use. Without treatment it tends to lead an aggressive course. SCLC is staged according to a two-stage system developed by the Veteran's Administration Lung Cancer study group as limited disease or extensive disease. Patients with limited disease have involvement restricted to the ipsilateral hemithorax that can be encompassed within a safe radiation treatment plan. Extensive disease is defined as the presence of overt metastatic disease. Patients with otherwise limited-stage disease with the presence of contralateral hilar, supraclavicular nodes, malignant pleural or pericardial effusions (as for this patient) are categorised as extensive-stage SCLC. The SCLC algorithm was revised in 2011 to include the TNM staging information, but as most of the literature classifies patients based on limited or extensive-stage disease, these definitions are still most relevant for clinical decision making.

Poor performance status (PS), extensive-stage disease, weight loss and markers associated with excessive bulk of the disease (such as LDH) are the most important adverse prognostic factors. Younger age, good PS, normal LDH and a single metastatic site are favourable prognostic factors in patients with extensive-stage SCLC (as for this patient). Chemotherapy with etoposide/platinum regimens given for four to six cycles is the treatment of choice for extensive-stage SCLC (as for this patient). After chemotherapy, patients achieving a complete response outside the chest and complete or partial response in the chest can be offered consolidative radiotherapy in the chest. Concurrent thoracic radiotherapy early during chemotherapy is the treatment of choice in limited disease, if the patient is fit enough and the tumour volume is not too bulky. Concurrent chemoradiation has no place in extensive-stage disease (as for this patient).

Brain metastases are common in SCLC. In patients who achieve a complete response to induction therapy, central nervous system (CNS) metastases will emerge over the next 2 years in approximately 50–60% of patients, and in 20–30% of patients, the brain will be the only apparent site of disease. Studies have shown that prophylactic cranial irradiation (PCI) can reduce the risk of CNS failure and improve survival, without excessive toxicity. So, most recent guidelines (like NCCN and ESMO) recommend that patients with any response to first-line treatment irrespective of stage should be offered prophylactic cranial irradiation (PCI) after the completion of first-line treatment (as for this patient).

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HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 48%

Question 220

Which of the following is associated with moderately severe thoracic scoliosis (Cobb angle 60–90°)?

a. Increased functional residual capacity
b. Increased residual volume/TLC ratio
c. Increased expiratory reserve volume
d. Reduced inspiratory capacity

Correct answers

b. Increased residual volume/TLC ratio
d. Reduced inspiratory capacity

Scoliosis alters the shape of the thoracic cavity and, therefore, also influences diaphragmatic function. Moderate and severe scoliosis usually cause a restrictive ventilatory pattern. A decrease in chest wall compliance and asymmetric inspiration caused by the deformation of the thoracic cavity (in idiopathic cases, frequently associated with lung hypoplasia) result in a decrease in vital capacity and TLC. The disease might also be associated with neuromuscular weakness that may further corrupt respiratory function. The Cobb angle indicates the severity of the disease: mild scoliosis is marked by Cobb angle <30°, and moderate cases between 30° and 45°. A Cobb angle of 60-90° described here (figure) indicates severe scoliosis that is usually associated with respiratory complications. Typical lung function changes consist of a decrease in TLC and a decrease in tidal volume. Residual volume (RV) remains usually in the normal range; therefore, the RV/TLC ratio increases. In most cases, functional residual capacity is maintained or slightly decreased (except if there is air trapping due to small airway compression). Both expiratory reserve volume and inspiratory capacity decrease.

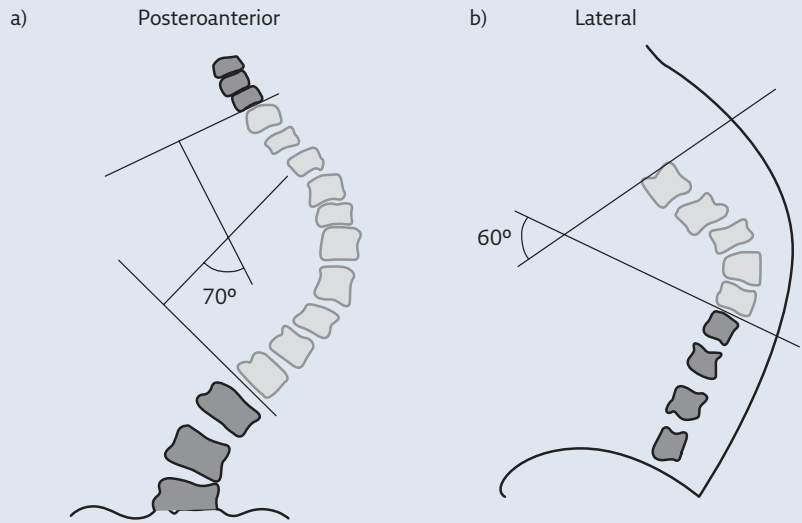

FIGURE. The Cobb angle is used to quantify the degree of scoliosis by drawing lines from the plane of the vertebrae that form both ends of the curvature and measuring the angle at the intersection. Reproduced from Tzelepis *et al.* (2010), The lung and chest wall diseases; *In:* Mason RJ, *et al.*, eds., Murray and Nadel's Textbook of Respiratory Medicine, 5th Edn; Oxford, Elsevier; pp. 2067–2083.

Reference

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HERMES Syllabus link: 3 Pulmonary function testing, 19 Diseases of the chest wall and respiratory muscles including the diaphragm
Angoff rating: 49%

Question 221

A 32-year-old man, known to be HIV-positive for 4 years, is referred to you for evaluation of pulmonary complaints and possible sputum induction. Approximately 2 years ago, the patient developed a chronic, productive cough that has persisted. The sputum colour varies, ranging from white to yellow and green. Several courses of antibiotic therapy have cleared the sputum colour to white each time, but sputum purulence recurs. He has had intermittent fever but does not have night sweats. He is dyspnoeic only on extreme exertion. He has not received anti-HIV medication or trimethoprim and sulfamethoxazole. He does not smoke cigarettes. He smoked marijuana in the past but quit 7 months ago. Physical examination reveals a thin, tired-looking man. The remainder of the physical examination is normal. A chest radiograph shows increased markings, primarily in the lung bases, but is unchanged compared with 3, 6 and 9 months ago. The CD4 count is 253 cells per mm^3, and serum lactate dehydrogenase is 120 $U \cdot L^{-1}$. Arterial blood gases while breathing ambient air are P_{aO_2} 88 mmHg (11.7 kPa), P_{aCO_2} 36 mmHg (4.8 kPa) and pH 7.44. What should be recommended?

a. Induced sputum sample to test for *Pneumocystis jiroveci*
b. CT scan of the chest
c. Sweat chloride test
d. Empiric therapy with trimethoprim and sulfamethoxazole
e. Biopsy of the nasal mucosa

Correct answer

b. CT scan of the chest

The patient's clinical history is suggestive for bronchiectasis, due to the recurrent bacterial lower respiratory tract infections in the past occurring because of an impaired immunological defence. Another differential diagnostic consideration would be lymphocytic interstitial pneumonitis in patients with HIV who have a long standing infiltrate.
The patient's clinical history is not suggestive for a *Pneumocystis* infection. Furthermore the patient is not hypoxaemic and his LDH is normal findings that are commonly encounterd in patients with a pneumocystis infection.
The sweat chloride test test is used to screen for cystic fibrosis, which is not likely in this case; most cystic fibrosis patients will have health problems since early childhood.
Empiric therapy with trimethoprim and sulfamethoxazole might resolve this episode of a lower respiratory tract infection but will not give an answer for the recurrent episodes of lower respiratory tract infections. However, trimethoprim and sulfamethoxazole might be indicated as a prophylaxis for pneumocystis infections as his CD4 count is low. Any World Health Organization (WHO) clinical stage of HIV infection with CD4 <350 cells per mm^3 or WHO clinical stage 3 or 4 irrespective of CD4 count should receive *P. jiroveci* pneumonia prophylaxis.
A nasal biopsy might be performed in a case where primary ciliary dyskinesia is suspected. If this would be the diagnosis, one would expect the patient to have complaints of recurrent respiratory tract infections from childhood onwards.

References

Pasteur MC, *et al.* British Thoracic Society guideline for non-CF bronchiectasis. *Thorax* 2010; 65: Suppl. 1, i1–i58.

World Health Organization. Consolidated Guidelines on HIV Prevention, Diagnosis, Treatment and Care for Key Populations. Geneva, WHO Press, 2014.

World Health Organization. Guidelines on Co-trimoxazole Prophylaxis for HIV-related Infections Among Children, Adolescents and Adults. Geneva, WHO Press, 2006.

HERMES Syllabus link: 6 Airway diseases, 7 Respiratory infections
Angoff rating: 50%

Question 222

A 75-year-old man with COPD has been treated with low-dose oral corticosteroids. He has had multiple acute exacerbations, which were treated with amoxicillin; the most recent one was 3 weeks ago. He now presents with pleuritic chest pain of acute onset, cough with purulent sputum, fever up to 38.5 ºC and right lower lobe consolidation on chest radiography. A sputum sample shows sheets of neutrophils with intra- and extracellular Gram-positive diplococci. The patient is admitted to the hospital.
Which of the following is the best initial empiric therapy for this patient?

a. Erythromycin, 250 mg intravenously every 6 h
b. Ceftriaxone, 2 g intravenously every 24 h
c. Doxycycline, 100 mg intravenously every 24 h
d. Penicillin G, 500 mg intravenously every 4 h
e. Trimethoprim–sulfamethoxazole, 160 mg trimethoprim plus 800 mg sulfamethoxazole, intravenously every 8 h

Correct answer

b. Ceftriaxone, 2 g intravenously every 24 h

The diagnosis is community-acquired pneumonia and the sputum sample is indicative of the presence of *Streptococcus pneumoniae*. As the patient has been treated with amoxicillin many times lately, the risk of resistance of *S. pneumoniae* is considered high not only to penicillins, but also to macrolides, tetracyclines and trimethoprim–sulfamethoxazole; therefore, treatment with ceftriaxone is a reasonable choice.

Reference

Woodhead M, *et al.* Guidelines for the management of adult lower respiratory tract infections. *Clin Microbiol Infect* 2011; 17: Suppl. 6, e1–e59.

HERMES Syllabus link: 6 Airway diseases, 7 Respiratory infections, 27 Associated specialties
Angoff rating: 70%

Question 223

A 46-year-old female with a BMI of 26 $kg \cdot m^{-2}$ suffers from OSAS. The patient's AHI in a recent sleep study was 34 events per h with an average of 30 obstructive and four central events per hour. You explain the available treatment options to the patient in the presence of her husband. She is not enthusiastic about nasal CPAP but agrees to try it. After 3 weeks, she declares that CPAP was not acceptable for her, mainly for psychological reasons. She asks for another treatment modality. Which is the next appropriate examination that helps to decide on an alternative treatment?

a. Measurement of thyroid hormones
b. Review of the sleep study regarding body position
c. Nasal endoscopy
d. Spirometry
e. Inspection of the oral cavity

Correct answer

e. Inspection of the oral cavity

The main treatment for OSAS is nocturnal CPAP. Adjunctive measures are lifestyle modification with regular sleeping hours, sufficient nocturnal rest, and avoidance of alcohol, sedatives and smoking. In recent trials, lifestyle modification combined with a very low-calorie diet provided some relief of OSAS in obese patients but there are doubts as to whether obesity can be persistently controlled by diet alone. Supine position may aggravate OSAS but positional therapy has not been shown to provide appropriate control of sleep-related breathing disturbances in OSAS. Nasal obstruction may aggravate OSAS, and promote snoring and sleep disturbances. However, treatment of chronic nasal obstruction with topical corticosteroids or surgery is not sufficiently effective as a sole therapy for OSAS. Spirometry is helpful in screening for concomitant obstructive or restrictive lung disease but is unlikely to contribute much to the selection of OSAS therapy in this patient. Hypothyroidism may predispose to OSAS but routine measurement of thyroid hormones in OSAS patients without clinical suspicion of thyroid dysfunction is not recommended because of the low diagnostic yield. Treatment of OSAS with a mandibular advancement device is an effective alternative to CPAP. In studies comparing CPAP with mandibular advancement device therapy, CPAP provided a more complete control of sleep apnoea. Therefore, CPAP is the primary recommended treatment. If CPAP is not feasible, a mandibular advancement device is a valuable alternative. It requires a minimal number of six to eight upper and lower teeth and, therefore, inspection of the oral cavity is essential to assess the feasibility of this therapy.

References

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Basner RC. Continuous positive airway pressure for obstructive sleep apnea. *N Engl J Med* 2007; 356: 1751–1758.

Johansson K, *et al.* Effect of a very low energy diet on moderate and severe obstructive sleep apnoea in obese men: a randomised controlled trial. *BMJ* 2009; 339: b4609.

Kohler M, *et al.* The role of the nose in the pathogenesis of obstructive sleep apnea. *Curr Opin Otolaryngol Head Neck Surg* 2009; 17: 33–37.

Randerath WJ, *et al.* Non-CPAP therapies in obstructive sleep apnoea. *Eur Respir J* 2011; 37: 1000–1028.

Winkelman JW, *et al.* Are thyroid function tests necessary in patients with suspected sleep apnea? *Sleep* 1996; 19: 790–793.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 55%

Question 224

Which of the following diseases is/are associated with upper lobe fibrosis and loss of volume on chest radiography?

a. Sarcoidosis
b. Hypersensitivity pneumonitis
c. Langerhans cell histiocytosis
d. Rheumatoid arthritis

Correct answers

a. Sarcoidosis
b. Hypersensitivity pneumonitis

Upper lobe fibrosis (usually posterior) associated with loss of volume is characteristic of the classic pulmonary granulomatous diseases of tuberculosis and sarcoidosis. Hypersensitivity pneumonitis which is also granulomatous histologically typically results in upper lobe fibrosis with volume loss as an end-stage radiological appearance of long-standing chronic disease. The radiographic opacities of Langerhans cell histiocytosis in which granuloma formation also occurs, tend to predominate in the upper and mid zones, but because of the development of multiple cystic areas, there is no loss of volume which may indeed be increased. Rheumatoid pulmonary fibrosis which is primarily fibrotic with no preceding granulomatous inflammation is similar to idiopathic pulmonary fibrosis and asbestosis and in these diseases, radiological evidence of fibrosis mainly affects the lower zones.

References

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Zinck SE, *et al*. CT of noninfectious granulomatous lung disease. *Radiol Clin North Am* 2001; 39: 1189–1209.

HERMES Syllabus link: 15 Occupational diseases, 16 Environmental diseases, 10 Interstitial lung disease, 13 Respiratory consequences of systemic/extrapulmonary disorders
Angoff rating: 46%

Question 225

Which of the following conditions is not included in the tetrad of symptoms usually associated with narcolepsy?

a. Sleep attacks
b. Hypnagogic hallucinations
c. Morning headaches
d. Sleep paralysis
e. Cataplexy

Correct answer

c. Morning headaches

Morning headaches are a feature of nocturnal hypoventilation, not narcolepsy.
The narcoleptic tetrad is: sleepiness (sometimes experienced as sudden attacks of sleepiness), cataplexy, hypnagogic hallucinations, and sleep paralysis.

Reference

Riha RL. Hypersomnia. *In:* Simonds AK, *et al.*, eds. ERS Handbook of Respiratory Sleep Medicine. Sheffield, European Respiratory Society, 2012; pp. 67–73.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 65%

Question 226

An 18-year-old woman has had a cough and progressive dyspnoea for the past 3 years. The cough is nonproductive and is usually associated with exercise. She has had episodes of bronchitis with purulent thick sputum lasting ~1 week, which were treated with antibiotics. Over the past year, she has experienced chronic fatigue, decreased exercise tolerance and increasingly frequent episodes of bronchitis. She has had a 3-week trial of oral corticosteroids, with little change in her symptoms. She is a nonsmoker. Her 20-year-old brother has asthma. The patient appears to be well nourished. Her blood pressure is 120/75 mmHg, pulse rate is 80 beats per min and regular, and respiratory rate is 18 breaths per min. A chest examination and radiograph are normal. Arterial blood gases on room air show a P_{aO_2} of 8.0 kPa (60 mmHg), P_{aCO_2} of 4.4 kPa (33 mmHg) and pH of 7.45. Pulmonary function tests show an FVC of 2.92 L (90% predicted), FEV_1 of 2.0 L (75% predicted) and FEV_1/FVC of 68%. FEV_1 increases by 10% following inhalation of albuterol. Sputum culture reveals *Staphylococcus aureus*.
Which test is most likely to lead you to the correct diagnosis?

a. A methacholine challenge test
b. A sinus radiograph
c. A barium oesophagram
d. A sweat chloride test
e. A flexible bronchoscopy

Correct answer

d. A sweat chloride test

Chronic cough and progressive dyspnoea in a patient with recurrent episodes of increased and purulent sputum, progressive fatigue, and reduced exercise tolerance suggest a progressive chronic lung disease with frequent flare-ups. The patient also has a moderate obstructive ventilatory defect and slight hypoxaemia with hypocapnia. Both the purulent exacerbations and isolation of *S. aureus* suggest bronchiectasis. Cystic fibrosis is a chronic progressive lung disease with bronchiectasis that may manifest itself in a young adult. A sweat chloride test is likely to lead to a correct diagnosis. Although her brother has asthma, the clinical pattern does not suggest asthma (no wheezing or paroxysmal dyspnoea) and oral steroids had no effect; consequently, a methacholine challenge test would not be expected to provide useful information. Chronic rhinosinusitis and gastro-oesophageal reflux are frequent causes of chronic cough but they are rarely associated with chronic dyspnoea, an obstructive ventilatory defect or hypoxaemia; therefore, neither sinus radiography nor a barium oesophagram is likely to confirm a diagnosis in this patient. Flexible bronchoscopy is unlikely to lead to a definite diagnosis. Chest CT (with contrast) would be useful to define the lung lesions and to confirm the presence of bronchiectasis; lung volumes and T_{LCO} measurement would also be useful to define lung function impairment in this patient.

References

Farrell PM, *et al.* Guidelines for diagnosis of cystic fibrosis in newborns through older adults: Cystic Fibrosis Foundation consensus report. *J Pediatr* 2008; 453: S4–S14.

Pratter MR, *et al.* An empiric integrative approach to the management of cough: ACCP evidence-based clinical practice guidelines. *Chest* 2006; 129: Suppl., 222S–231S.

HERMES Syllabus link: 6 Airway diseases, 26 Genetic and developmental disorders
Angoff rating: 59%

Question 227

A 35-year-old female presents to her family physician with unproductive cough and fever up to 37.8°C (axillary) during the past 48 h. On physical examination, she presents end-inspiratory crackles at the left lung base on auscultation, with no other abnormal findings. Chest radiography reveals a small consolidation in the left lower lung field. Her S_{pO_2} was 97% on room air.
Which of the following investigations is necessary for the management of this patient?

a. Pneumococcal urine antigen test
b. Serological testing for *Mycoplasma* and *Chlamydia*
c. Blood cultures
d. Sputum sampling for Gram stain and culture
e. No further tests are required

Correct answer

e. No further tests are required

This patient has community-acquired pneumonia of low severity (CRB-65 score 0; table). According to current guidelines, she should be routinely managed empirically with antibiotics as an outpatient and no further investigations are necessary in the primary care setting in this low-risk patient.

Table The CURB-65 and CRB-65 indices

	Sign/finding	CURB-65	CRB-65
C	Mental confusion	•	•
U	Blood urea concentration >7 mmol · L^{-1}	•	
R	Respiratory rate ≥30 breaths per min	•	•
B	Systolic blood pressure <90 mmHg or diastolic blood pressure ≤60 mmHg	•	•
65	Age ≥65 years	•	•

Several scores have been developed to assess severity of pneumonia and associated mortality. Two well-validated and simple scores are the CURB-65 and its derivative that does not require a laboratory study, the CRB-65. Lim *et al.* (2003) have compared the two scores. Using the CURB-65 index, pneumonia is considered mild (score 0–1, mortality 1.5%), moderate (score 2, mortality 9.2%), or severe (score 3–5, mortality 22%). Using the CRB-65 index, which does not depend on laboratory tests and is therefore particularly suitable for primary care, pneumonia is considered mild (score 0, mortality 1.5%), moderate (score 1–2, mortality 8.2%), or severe (score 3–4, mortality 31%). In patients with a CRB-65 of ≥1 (except age ≥65 years alone) hospitalisation should be seriously considered.

In more severe patients requiring hospitalisation, blood cultures should be obtained and a sputum Gram stain performed if a purulent sputum sample can be obtained and processed in a timely manner. Pneumococcal or *Legionella* urine antigen tests are recommended in patients hospitalised for severity of illness. Serological testing for *Mycoplasma* and *Chlamydia* species is more useful in epidemiological studies than for acute management of an individual patient.

References

Lim WS, *et al.* BTS guidelines for the management of community-acquired pneumonia in adults: update 2009. *Thorax* 2009; 64: Suppl. 3, iii1–iii55.

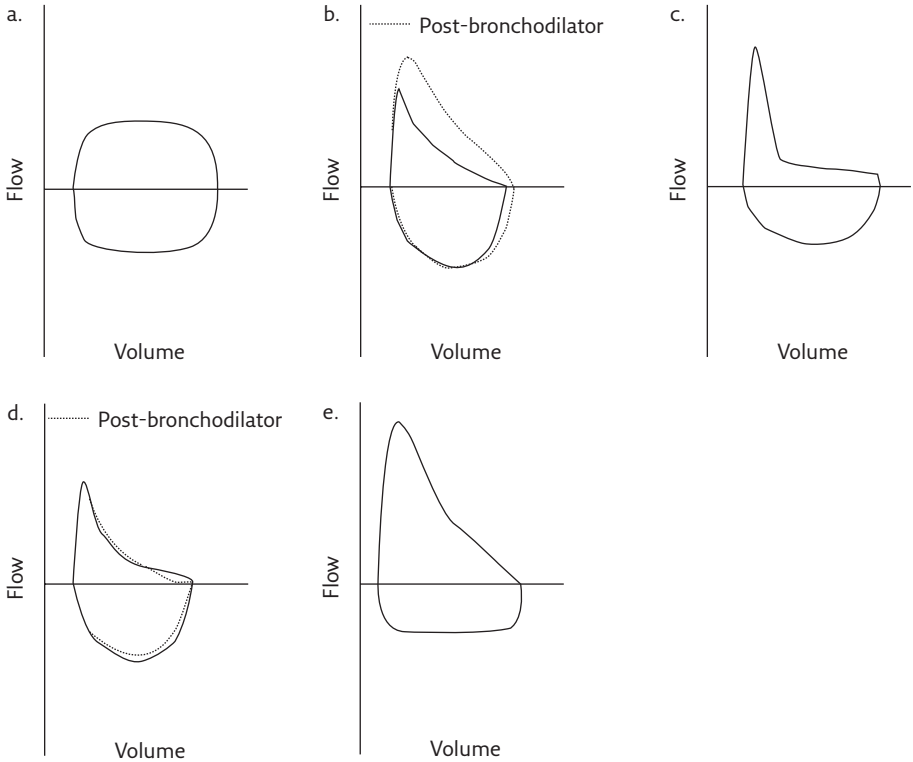
Lim WS, *et al.* Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. *Thorax* 2003; 58: 377–382.

Woodhead M, *et al.* Guidelines for the management of adult lower respiratory tract infections: summary. *Clin Microbiol Infect* 2011; 17: Suppl. 6, 1–24.

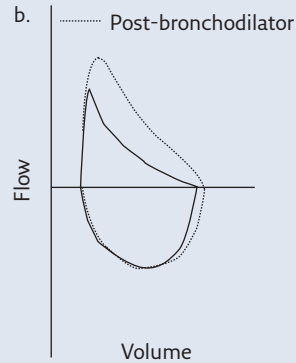
HERMES Syllabus link: 7 Respiratory infections
Angoff rating: 65%

Question 228

A 40-year-old, male nonsmoker who is wheezing and has a persistent cough accompanied by episodic dyspnoea is referred to your office for spirometric evaluation.
Which of the following flow–volume curves is most likely to be recorded?



Correct answer



The history of this patient with episodic dyspnoea, cough and wheeze is suggestive of bronchial asthma. The typical finding in spirometry is reversible airflow obstruction, *i.e.* an improvement in FEV_1 or FVC of ≥200 mL and ≥12% after inhalation of a bronchodilator. This finding is shown schematically in the curve above. The procedure to assess bronchodilator response and the minimal change assumed to represent reversibility are listed in the table.

None of the other flow–volume loops shows reversibility. Flow–volume loop d is consistent with airflow obstruction that is not acutely reversible. Although certain patients with asthma may lack acute reversibility, a positive bronchodilator response, as in b, would be more characteristic. Curves a and e show flow–volume loops consistent with fixed stenosis of central airways and variable extrathoracic tracheal stenosis, respectively. Curve c is consistent with expiratory airway collapse, as might occur in pulmonary emphysema due to loss of elastic recoil or in tracheobronchial malacia.

Table Summary of the procedures relating to bronchodilator response

Procedures suggested to minimise differences within and between laboratories
Assess lung function at baseline.
Administer salbutamol in four separate doses of 100 µg through a spacer.
Re-assess lung function after 15 min. If you want to assess the potential benefits of a different bronchodilator, use the same dose and the same route as used in clinical practice. The waiting time may be increased for some bronchodilators.
An increase in FEV_1 and/or FVC ≥12% of control and ≥200 mL constitutes a positive bronchodilator response
In the absence of a significant increase in FEV_1 and/or FVC, an improvement in lung function parameters within the tidal breathing range, such as increased partial flows and decrease of lung hyperinflation, may explain a decrease in dyspnoea
The lack of a bronchodilator response in the laboratory does not preclude a clinical response to bronchodilator therapy

Reproduced and modified from Pellegrino *et al.* (2005).

Reference

Pellegrino R, *et al.* Interpretative strategies for lung function tests. *Eur Respir J* 2005; 26: 948–968.

HERMES Syllabus link: 3 Pulmonary function testing
Angoff rating: 74%

Question 229

A 68-year-old male with amyotrophic lateral sclerosis is consulting you in the presence of his wife and daughter. Four months ago, medical examinations performed to evaluate the cause of weakness in his arms led to the diagnosis. During the consultation, the patient and his family ask you to give them an honest estimate of how long he has to live. The patient is currently in fairly good condition, has a normal weight and is able to walk without dyspnoea, and he has no orthopnoea. Neurological examination confirms weakness of both arms, more on the left, and fasciculations of the tongue. Which one of the following examinations is least likely to give you information relevant for assessing the prognosis?

a. Spirometry
b. 6-min walking distance
c. Peak cough flow
d. Observing the patient when drinking water
e. Sniff nasal inspiratory pressure

Correct answer

b. 6-min walking distance

Amyotrophic lateral sclerosis (ALS) is a degenerative disease affecting the upper and lower motor neurons. It generally affects elderly males and females (>65 years) but may occur in younger subjects as well. The aetiology is not known but a genetic predisposition seems to play a role, since there is a familiar form of ALS. The disease has a grim prognosis with a survival from onset of symptoms of 2–4 years. Death occurs mostly from respiratory causes, including subacute and chronic respiratory failure due to respiratory muscle weakness, and pneumonia and asphyxia due to foreign body aspiration. In the most common spinal-onset form of ALS (80% of cases), initial presentation includes asymmetric limb weakness with progressive difficulties walking and using hands and arms. The bulbar-onset form of ALS (20% of cases) is characterised by dysarthria, difficulties swallowing and ineffective cough. Both the spinal and bulbar forms are also associated with respiratory muscle weakness leading to progressive respiratory failure. Compared with the spinal-onset form, survival in the bulbar-onset form is reduced.

Recent studies have suggested that noninvasive positive pressure ventilation improves quality of life and survival of patients with ALS. Patients with the spinal form are more likely to benefit than those with the bulbar form. Vital capacity has been shown to correlate with prognosis in ALS. Typically, vital capacity measured in the supine position is more impaired than that in the upright position, a finding suggesting diaphragmatic weakness. Respiratory muscle strength is also assessed by the sniff nasal inspiratory pressure, which is easier to perform for ALS patients than maximal inspiratory pressure manoeuvres. A reduction of the sniff nasal inspiratory pressure to <40 cmH_2O has been associated with survival of <6 months. Weakness of expiratory muscles and ineffective cough may predispose to respiratory infections. Letting patients cough over the course of a forced expiratory manoeuvre normally shows supramaximal flows, *i.e.* flow rates that exceed the maximal expiratory flow curve during spirometry. The inability to achieve supramaximal flow and a peak cough flow of <270 $L \cdot min^{-1}$ have also been associated with a poor prognosis in ALS. Contrary to the tests mentioned above, the 6-min walk distance is not used to assess prognosis in ALS.

References

Andersen PM, *et al.* Good practice in the management of amyotrophic lateral sclerosis: clinical guidelines. An evidence-based review with good practice points. *Amyotroph Lateral Scler* 2007; 8: 195–213.

Gil J, *et al.* Causes of death amongst French patients with amyotrophic lateral sclerosis: a prospective study. *Eur J Neurol* 2008; 15: 1245–1251.

Miller RG, *et al.* Practice parameter update: The care of the patient with amyotrophic lateral sclerosis: drug, nutritional, and respiratory therapies (an evidence-based review): report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology* 2009; 73: 1218–1226.

Simonds AK. Recent advances in respiratory care for neuromuscular disease. *Chest* 2006; 130: 1879–1886.

HERMES Syllabus link: 18 Respiratory failure
Angoff rating: 57%

Question 230

A 42-year-old male never-smoker complains about dyspnoea occurring after physical exercise. He was a professional water polo player for two decades. His BMI is 35 $kg \cdot m^{-2}$. He is non-atopic, has cardiomegaly and a pulse rate of 58 beats per min. His baseline lung function is normal (FEV_1 3.8 L, 105% predicted). 15 min after a standard maximal exercise protocol his FEV_1 is 2.9 L and his pulse rate is 68 beats per min.
The most probable cause of the findings is:

a. Obesity-related airway hyperresponsiveness
b. Exercise-induced bronchoconstriction
c. Exercise-induced anaphylaxis
d. Exercise-induced vocal cord dysfunction
e. Cardiomyopathy

Correct answer

b. Exercise-induced bronchoconstriction

FEV_1 increases in healthy subjects during exercise due to sympathetic activation causing bronchodilation. If no change occurs it is still counted as a normal airway response. In asthma, the inflammatory cells in the airway wall, including mast cells, release bronchoconstrictive mediators during exercise due to drying and cooling of the airways. These mediators result in bronchoconstriction usually developing within 5–20 min after exercise. This is called exercise-induced bronchospasm and it is considered as a specific form of airway hyperresponsiveness, and exercise testing is used as an indirect airway challenge (in other words bronchoprovocation testing) to assess airway hyperresponsiveness. The test is referred to as indirect because bronchoconstriction does not occur directly due to the stimulus, but due to the mediators released by the stimulus. In this case, the decrease of 24% in FEV_1 is diagnostic for exercise-induced asthma.
Exercise can cause systemic reactions including anaphylaxis; however, in this case report there is no indication of tachycardia or any other symptoms of anaphylaxis. Vocal cord dysfunction results in variable and non-reproducible upper airway obstruction due to variable closure of the vocal cords often manifested as inspiratory stridor.

References

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Palange P, *et al.* Recommendations on the use of exercise testing in clinical practice. *Eur Respir J* 2007; 29: 185–209.

HERMES Syllabus link: 6 Airway diseases
Angoff rating: 64%

Question 231

A 21-year-old female is referred to your clinic for further evaluation of her asthma. She describes typical symptoms of asthma including night-time cough and wheeze, as well as shortness of breath in the daytime that limits her ability to play sport. She has been prescribed an inhaled corticosteroid but she does not wish to take this medication because she has heard that steroids are dangerous. In particular, she states that she read about a person that developed 'a brain fungal infection when they used steroids'.
Which approach is best used to enhance her adherence to therapy?

a. Inform her that she must take the inhaled steroid.
b. Insist that her idea that brain fungal infection occurs as a side-effect of the course of treatment of asthma with corticosteroids is nonsense and illustrate this point by reference to distinguished medical journals.
c. Suggest that she seek care with alternative, complimentary medicine such as herbal therapy.
d. Acknowledge her beliefs and indicate that you do not necessarily share this concern, but agree to consider alternative therapies such as a leukotriene inhibitor.
e. Recognising that she is at extreme risk of a further, possibly fatal exacerbation, administer an intramuscular corticosteroid, to keep her safe.

Correct answer

d. Acknowledge her beliefs and indicate that you do not necessarily share this concern, but agree to consider alternative therapies such as a leukotriene inhibitor.

Adherence to medication is a behaviour. A framework for understanding the main drivers of adherence is the Capability, Opportunity, Motivation Behavioral framework. This framework suggests that health behaviours, including adherence to therapy, are driven by one of three dimensions: comprehension, opportunity and motivation. In this case, the patient's comprehension is the challenge to her adherence. She has developed an abnormal belief in the side-effects related to steroids. Insisting that she should change her beliefs or ignore them, even if it is obvious that she is at risk, without acknowledging her concerns will not achieve enhanced adherence. Thus, shared decision-making, which is evidence based for the management of asthma, is likely to enhance her adherence to therapy.

Reference

Wilson SR, *et al*. Shared treatment decision making improves adherence and outcomes in poorly controlled asthma. *Am J Respir Crit Care Med* 2010; 181: 566–577.

HERMES examination blueprint: 6 Airway diseases
Angoff rating: 47%

Question 232

A 42-year-old male with COPD returning from a trip to Kenya 6 weeks ago has been diagnosed with smear-positive pulmonary tuberculosis (TB) after a 10-day hospitalisation for a respiratory tract infection. His 38-year-old wife is asymptomatic with normal chest radiography and has an unremarkable past medical history. Her tuberculin skin test (TST) is 0 mm.
Which of the following should be recommended to her?

a. 9 months' treatment with isoniazid
b. Evaluation with an interferon-γ release assay
c. Bacille Calmette-Guérin vaccination
d. Repeat TST 2–3 months later
e. No further testing or treatment

Correct answer

d. Repeat TST 2–3 months later

The wife represents a close contact of a patient with active smear-positive pulmonary TB. Given the short history of her husband's illness, the evaluation of a TST in this woman may fall in the 'window period' after a recent sensitisation, usually lasting 4–8 weeks. Therefore, a second TST after 2–3 months should be performed in order to evaluate conversion and take a definitive decision on treatment of latent TB infection. At the current time, there is no need for treatment of latent tuberculosis and BCG vaccination is not indicated. An interferon-γ release assay is indicated as an alternative to TST or to confirm a positive TST. Moreover, in this apparently healthy woman there is no reason to consider a false-negative result of the TST.

References

Horsburgh CR Jr, *et al*. Clinical practice. Latent tuberculosis infection in the United States. *N Engl J Med* 2011; 364: 1441–1448.

Zellweger JP. Latent tuberculosis. *In:* Palange P, *et al*., eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 248–250.

HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 61%

Question 233

An 18-year-old competitive swimmer is referred to your clinic for evaluation. She is very keen to obtain a certificate for competition that confirms that she has asthma. She reports that she regularly uses short- and long-acting β-agonists as well as an inhaled corticosteroid for her asthma. Physical examination reveals no wheezing. Further testing shows an exhaled nitric oxide fraction (F_{ENO}) of 3 ppb and serum IgE concentration of 3 $kU \cdot L^{-1}$, and a full blood count shows an eosinophil count of $>1.5 \times 10^5$ per L. A bronchial provocation test with methacholine demonstrates a provocative concentration causing a 10% fall in FEV_1 of 16 $mg \cdot mL^{-1}$. Peak flow recorded by the patient over a month shows normal diurnal variation (9%) and the patient has normal spirometry.
Which of the test results makes asthma unlikely in this case?

a. The F_{ENO}
b. The IgE level
c. The spirometry
d. The methacholine provocation test
e. The eosinophil count

Correct answer

d. The methacholine provocation test

Asthma can be difficult condition to diagnose. The most reliable diagnosis is made by finding a significant variation in airflow over time. Usually, this is achieved by repeated spirometry, particularly in the morning before the patient has taken any bronchodilator therapy, or having the patient monitor their peak expiratory flow rate. In the absence of excessive peak flow variability (>10% within a day), a normal bronchoprovocation test makes the diagnosis of asthma extremely unlikely. Many patients with asthma, especially when treated with inhaled corticosteroids, have normal IgE, peripheral blood eosinophil levels and normal F_{ENO}, making these tests too insensitive to be reliable for exact clinical diagnosis, as would be required to issue an official therapeutic medication exemption form.

References

Crapo RO, *et al.* Guidelines for methacholine and exercise challenge testing – 1999. *Am J Respir Crit Care Med* 2000; 161: 309–329.

Fitch KD, *et al.* Asthma and the elite athlete: summary of the International Olympic Committee's consensus conference, Lausanne, Switzerland, January 22–24, 2008. *J Allergy Clin Immunol* 2008; 122: 254–260.

HERMES Syllabus link: 1 Structure and function of the respiratory system, 3 Pulmonary function testing
Angoff rating: 61%

Question 234

A 58-year-old, never-smoking woman is referred to you because of progressive dyspnoea. This patient grew up in a rural area. She is now divorced and has lived alone in a new, four-room flat for 4 years. She works part-time as a house cleaner in a home for children. For 1 h a week, she works in the laundry room, where she sometimes notices humid walls. The chest radiograph is normal. Pulmonary function testing reveals an FEV_1 of 1.45 L (77% of predicted), an FVC of 1.66 L (74% of predicted) and a T_{LCO} of 2.3 $mmol \cdot min^{-1} \cdot kPa^{-1}$ (34% of predicted). A pulmonary thromboembolism has been excluded by a negative D-Dimer test. The patient's family doctor advises her to stop working for 4 weeks. Dyspnoea and pulmonary function thereafter are unchanged. Further diagnostic work-up reveals a cell count in the bronchoalveolar lavage (BAL) fluid of 653 per µL (60% lymphocytes, 5% neutrophils, 3% mast cells and 32% macrophages). Serum precipitins to common antigens are negative.
In this situation, which of the following statements is correct?

a. Lymphocytic alveolitis is specific to hypersensitivity pneumonitis.
b. The BAL findings together with the normal chest radiograph and a ground-glass pattern on HRCT are suggestive of hypersensitivity pneumonitis.
c. The suspected allergen is probably in the work environment of the patient.
d. For the diagnosis of hypersensitivity pneumonitis, an antigen has to be identified.
e. The patient is equally likely to be suffering from desquamative interstitial pneumonitis as from hypersensitivity pneumonitis.

Correct answer

b. The BAL findings together with the normal chest radiograph and a ground-glass pattern on HRCT are suggestive of hypersensitivity pneumonitis.

The patient's history is compatible with a hypersensitivity pneumonitis, especially in the absence of hilar and mediastinal lymphadenopathy. Otherwise, sarcoidosis might also be considered. Other diseases such as sarcoidosis or lymphocytic interstitial pneumonitis may also present as a 'lymphocytic alveolitis'. If >50% of lymphocytes are found in a diffuse parenchymal lung disease, hypersensitivity pneumonitis is very likely. The suspected allergen is unlikely to be in the workplace because the patient does not improve after a 4 weeks leave from her job.
In some cases, it is not possible to detect the responsible antigen in patients proven to have hypersensitivity pneumonitis.
Desquamative interstitial pneumonia (DIP) is a rare condition that usually affects smokers in their fourth or fifth decades. It is twice as common in men as in women. The term DIP was originally used to describe a diffuse parenchymal lung disease that was believed to occur as a result of desquamation of alveolar epithelial cells. However, it is now known that this pathological abnormality represents accumulation of macrophages, which usually contain pigment related to tobacco smoke. This observation has prompted the theory that DIP and respiratory bronchiolitis-associated interstitial lung disease (ILD) may be related conditions representing two ends of a spectrum of smoking-related ILD.

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HERMES Syllabus link: 10 Interstitial lung disease, 13 Respiratory consequences of systemic/extrapulmonary disorders, 15 Occupational diseases
Angoff rating: 52%

Question 235

A 58-year-old woman is referred to you. She has dyspnoea on minimal exertion, stopped smoking 5 years ago, and is on regular treatment with bronchodilators and inhaled corticosteroids. Pulmonary function tests show FEV_1 0.41 L (18% predicted), FVC 0.82 L (30% predicted), FEV_1/FVC 51%, TLC 8.12 L (170% predicted) and residual volume 6.49 L (359% predicted). Her T_{LCO} is 15% of predicted. On exercise testing, her peak oxygen consumption is 21% predicted. Chest CT shows diffuse emphysema. Over the last 16 months, her clinical condition has remained stable but pulmonary function has slightly declined.
What is the most appropriate next step for the management of this patient?

a. Continue the current medical treatment only.
b. Refer for evaluation for lung transplantation.
c. Bronchoscopic lung volume reduction.
d. Lung volume reduction surgery.
e. Pulmonary rehabilitation followed by lung volume reduction surgery.

Correct answer

b. Refer for evaluation for lung transplantation.

This 58-year-old patient with COPD of Global Initiative for Chronic Obstructive Lung Disease grade 4 is highly symptomatic and her peak oxygen consumption is very low. She should be referred for evaluation for lung transplantation to a specialist centre. The decision of whether a patient with severe COPD should be referred for lung transplantation or not is based on various factors:

- Severity of functional impairment
- Comorbidity
- Lung function and changes in lung function over time
- Blood gases
- Presence of pulmonary hypertension

Transplantation improves functional capacity in COPD. Whether it also improves survival is less clear.
In the National Emphysema Treatment Trial, the overall survival advantage in patients undergoing lung volume reduction surgery was best in patients with upper lobe emphysema and low exercise capacity. Patients with FEV_1 <20% predicted and either T_{LCO} <20% predicted or non-upper lobe emphysema on chest CT had a marked increase in early mortality. Thus, lung volume reduction surgery is less effective in homogenous emphysema and bears the risk of worsening gas exchange in this patient with very low T_{LCO}. A lung volume reduction procedure might be considered as a bridge to transplant in highly selected patients.

References

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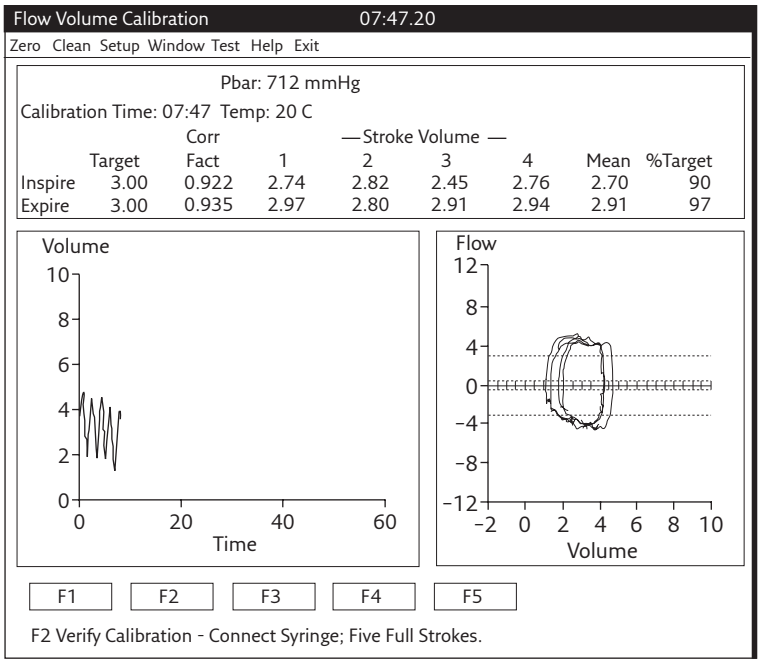
National Emphysema Treatment Trial Research Group. Patients at high risk of death after lung-volume-reduction surgery. *N Engl J Med* 2001; 345: 1075–1083.

HERMES Syllabus link: 6 Airway diseases
Angoff rating: 56%

Question 236

Your laboratory technician calls you one morning because she has difficulties calibrating the flow meter of the body plethysmograph. You verify appropriate function of the 3-L calibration syringe. Then, you check the recorded calibration procedure, which is displayed on the computer screen:



What is the most appropriate conclusion?

a. The flow meter has an acceptable precision but the accuracy is not satisfactory.
b. There is a leak in the connection between the syringe and the flow meter.
c. The precision of the flow meter is greater for inspiration than for expiration.
d. Compensation for the electronic drift will provide acceptable flow measurements.
e. Calibration problems are related to inaccurate measurement of barometric pressure.

Correct answer

b. There is a leak in the connection between the syringe and the flow meter.

The recorded calibration procedure shows a large variation in inspiratory and expiratory volume with a systematic difference between the two: inspiration 90% target; expiration 97% target. The flow–volume loops show a volume drift, *i.e.* a displacement of the curves that should ideally start and end at exactly the same volume. Potential causes of such a drift are leaks in the spirometer or flow meter, or in the calibration syringe or connecting tube. Electronic instability of the measurement device may also cause drift in the recorded signal but the drift in the example is very large and unstable, which precludes acceptable flow measurements.
According to recommended standards, precision of a flow meter for spirometry should be within 3% of the true value. The deviation of measured volumes from the target of 3 L exceeds this range to a variable degree both in inspiration and in expiration. Inaccurate measurement of barometric pressure may lead to incorrect measurement of airflow and volume but this would not explain the large variability in the measured volumes.

Reference

Miller MR, *et al.* Standardisation of spirometry. *Eur Respir J* 2005; 26: 319–398.

HERMES Syllabus link: 3 Pulmonary function testing
Angoff rating: 53%

Question 237

A 68-year-old man is treated with nocturnal CPAP at 8 mbar because of a central sleep apnoea syndrome due to his congestive heart failure. His medical history is remarkable for aortocoronary bypass surgery 2 years ago, after his second myocardial infarction. His left ventricular ejection fraction is 30%. He is treated with diuretics, angiotensin-converting enzyme inhibitors, spironolactone and β-blockers. His ECG reveals sinus rhythm and the R-wave is lacking in the anterior leads. He has problems wearing the CPAP mask every night and he asks about the benefit of CPAP treatment. Which of the following benefits is scientifically established?

a. Decreased mortality
b. Decreased risk of hospitalisation due to heart failure
c. Decreased need for cardiac medication
d. Increased left ventricular ejection fraction
e. Better sleep quality at night

Correct answer

d. Increased left ventricular ejection fraction

CPAP therapy for central sleep apnoea is controversial but has been shown to increase left ventricular ejection fraction. CPAP increases the intrathoracic pressure and, therefore, lowers the cardiac preload and transmural cardiac pressure; CPAP decreases the sympathetic overactivity that accompanies central sleep apnoea. These mechanisms support the failing heart and increase the left ventricular ejection fraction.
CPAP has been shown to decrease neither mortality or the need for cardiac medications nor hospitalisation rate. CPAP also has not consistently improved the sleep quality of patients with central sleep apnoea due to heart failure.

Reference

Brack T, *et al.* Cheyne–Stokes respiration in patients with heart failure: prevalence, causes, consequences and treatments. *Respiratory* 2012; 83: 165–176.

Bradley TD, *et al.* Continuous positive airway pressure for central sleep apnea and heart failure. *N Engl J Med* 2005; 353: 2025–2033.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 60%

Question 238

Which of the following statements concerning the management of spontaneous pneumothorax is/are true?

a. Observation is the preferred method in an asymptomatic patient with a rim of 3 cm.
b. A small (visible rim at the level of the hilum of ~1 cm) pneumothorax in a patient with dyspnoea is best treated by observation.
c. Prevention of recurrence is best achieved by pleurodesis.
d. Surgical treatment is indicated for the first episode of secondary pneumothorax.

Correct answer

c. Prevention of recurrence is best achieved by pleurodesis.

In the case of a large asymptomatic pneumothorax, aspiration or drainage is the preferred mode of treatment. Patients with primary or secondary spontaneous pneumothorax and symptoms such as breathlessness associated with any size of pneumothorax should undergo active intervention. The risk of a recurrence after a spontaneous pneumothorax is around 40–50%. After pleurodesis with instillation of talc, this risk is around 10%. If pleurodesis is established by a surgical procedure (pleural rubbing and/or partial pleurectomy), this risk is only 1–5 %. Surgical intervention is only indicated in cases of a persistent (large) air leak or for a recurrent secondary pneumothorax.

References

Light RW, *et al.* Textbook of Pleural Diseases. 2nd Edn. London, Hodder Arnold, 2008.

MacDuff A, *et al.* Management of spontaneous pneumothorax: British Thoracic Society Pleural Disease Guideline 2010. *Thorax* 2010; 65: Suppl. 2, ii18–ii31.

HERMES Syllabus link: 20 Pleural diseases
Angoff rating: 57%

Question 239

Which of the following statements regarding the role of echocardiography and right heart catheterisation in the evaluation of pulmonary hypertension (PH) is/are correct?

a. Echocardiography is the investigation of choice for noninvasive screening in suspected PH.
b. Echocardiographic diagnosis of PH is based on tricuspid regurgitation peak velocity and Doppler-calculated pulmonary arterial systolic pressure at rest assuming a normal right atrial pressure of 5 mmHg.
c. PH has been defined as an increase in mean pulmonary arterial pressure ≥25 mmHg and a pulmonary capillary wedge pressure ≥15 mmHg at rest, as assessed by right heart catheterisation.
d. Right heart catheterisation is mandatory to confirm the diagnosis of pulmonary arterial hypertension in most patients.

Correct answers

a. Echocardiography is the investigation of choice for noninvasive screening in suspected PH.
b. Echocardiographic diagnosis of PH is based on tricuspid regurgitation peak velocity and Doppler-calculated pulmonary arterial systolic pressure at rest assuming a normal right atrial pressure of 5 mmHg.
d. Right heart catheterisation is mandatory to confirm the diagnosis of pulmonary arterial hypertension in most patients.

PH is defined as an increase in mean pulmonary arterial pressure (mean P_{pa}) ≥25 mmHg at rest, as assessed by right heart catheterisation (RHC). The terms 'pulmonary hypertension' and 'pulmonary arterial hypertension' appear to be quite similar, and this has led to confusion and ambiguity in both common clinical practice and the medical literature. In the updated clinical classification of PH, 37 clinical conditions with PH are classified into six groups according to pathological, pathophysiological and therapeutic characteristics: pulmonary arterial hypertension (group 1); pulmonary veno-occlusive disease and/or pulmonary capillary haemagiomatosis (group 1′); PH due to left heart disease (group 2); PH due to lung diseases and/or hypoxia (group 3); chronic thromboembolic PH (CTEPH) (group 4); and PH with unclear and/or multifactorial mechanisms (group 5).
Echocardiography is an excellent noninvasive tool to screen for the presence of PH and to follow the progression of the disease. Indeed, echocardiographic estimates of *P*pa generally correlate well with those obtained by RHC. However, echocardiography may both overestimate and underestimate pulmonary arterial systolic pressures. Guidelines on PH from the European Society of Cardiology and the European Respiratory Society delineate criteria for estimating the likelihood of PH based on the tricuspid regurgitation peak velocity, the Doppler-calculated systolic P_{pa} at rest and additional echocardiographic parameters that might raise or reinforce the suspicion of PH.
In clinical practice, PH is discovered by Doppler echocardiography, either performed for this purpose or requested for another indication. In the majority of patients, one of the two most common clinical PH groups can be found (left heart disease and lung diseases) either directly by echocardiography (left heart disease), or by additional procedures, such as chest radiography, pulmonary function tests and HRCT of the chest (lung diseases). In these cases, the invasive confirmation of PH is not generally required, except in specific circumstances, such as in candidates for conventional cardiac surgery or for heart or lung transplantation.
Pulmonary arterial hypertension is characterised by elevated pulmonary arterial resistance. Therefore RHC with a measured mean *P*pa ≥25 mmHg and a wedge pressure ≤15 mmHg is necessary to diagnose the condition. A wedge pressure >15 mmHg points to a post-capillary form of PH, and excludes pulmonary arterial hypertension. According to the current guidelines, RHC is indicated in all patients with pulmonary arterial hypertension to confirm the diagnosis, to evaluate the severity, and when pulmonary arterial hypertension-specific drug therapy is considered.

References

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HERMES Syllabus link: 14 Pulmonary vascular diseases
Angoff rating: 52%

Question 240

Which of the following statements concerning malignant mesothelioma of the pleura is true?

a. Mesothelioma is linked to cigarette smoking.
b. Lack of mesothelin in the pleural fluid most likely excludes a pleural mesothelioma.
c. Immunohistology distinguishes mesothelioma from adenocarcinoma.
d. The histological subtype is essential for the selection of treatment.
e. Pleural plaques are premalignant lesions.

Correct answer

c. Immunohistology distinguishes mesothelioma from adenocarcinoma.

Mesothelioma is linked to asbestos exposure and probably to radiotherapy. Smoking, however, is not a risk factor for mesothelioma.
Mesothelin in the pleural fluid is a tumour marker with a low sensitivity (67%) but a high specificity (98%) for pleural mesothelioma; therefore, mesothelin is not suited to exclude mesothelioma.
Cytological examination of pleural fluid might not be able to distinguish between malignant mesothelioma and pleural metastases of an adenocarcinoma (cells from these two types of malignancies may be cytologically indistinguishable from each other), immunohistological examination of a pleural biopsy remains the gold standard method to distinguish between these two diagnoses.
There are three histological subtypes of mesothelioma: epitheloid, sarcomatoid and mixed type. The epitheloid subtype has the best prognosis, but the histological subtype is not essential for the selection of treatment.
There is no evidence that pleural plaques confer an increased risk of lung cancer or pleural mesothelioma within a population of individuals having the same cumulative asbestos exposure.

References

Ameille J, *et al.* Asbestos-related cancer risk in patients with asbestosis or pleural plaques. *Rev Mal Respir* 2011; 28: e11–e17.

Hollevoet K, *et al.* Serum mesothelin for diagnosing malignant pleural mesothelioma: an individual patient data meta-analysis. *J Clin Oncol* 2012; 30: 1541–1549.

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National Comprehensive Cancer Network. NCCN Clinical Guidelines in Oncology Version 1.2014: Malignant Pleural Mesothelioma. Available from: www.nccn.org

HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 55%

Question 241

A 75-year-old woman with severe COPD is admitted to the hospital with hypercapnic respiratory failure. She has been taking long-term corticosteroids and, during exacerbations, receives 40 mg prednisolone per day. On day 7 of mechanical ventilation, the patient is febrile with a temperature to 39ºC and has purulent sputum. Her leukocyte count is 18 000 cells per µL. A chest radiograph shows new bilateral lower-lobe patchy infiltration. She is treated with amikacin and imipenem. 3 days later, she has a reduction in her fever and her sputum becomes slightly less purulent, but her infiltrates persist and she remains mechanically ventilated. A sputum culture obtained before starting therapy shows *Escherichia coli* that is sensitive to both medications she is receiving. No other organisms are found on the sputum culture. Which of the following is the most appropriate decision in the management of this patient's therapy at this time?

a. Continue amikacin and imipenem.
b. Discontinue amikacin and continue imipenem.
c. Continue amikacin and imipenem, and add a macrolide.
d. Continue amikacin, discontinue imipenem and add vancomycin.
e. Continue amikacin and imipenem, and add fluconazole.

Correct answer

b. Discontinue amikacin and continue imipenem.

Based on her history, and clinical and laboratory data, this patient has late-onset (>5 days in the hospital) ventilator-associated pneumonia (VAP) and presents risk factors for multidrug-resistant pathogens, such as immunosuppressive therapy (*e.g.* corticosteroid use). Recent evidence suggests that antipseudomonal β-lactam monotherapy is sufficient if there is a low prevalence of multidrug-resistant, Gram-negative bacteria locally. However, aminoglycosides should still be combined with the β-lactam antibiotic in the initial treatment of VAP. This patient showed signs of a clinical response to treatment with lower temperature and clearer sputum. Lung function and radiological improvement may take longer to improve. According to guidelines for the management of VAP, antibiotic de-escalation is indicated.

References

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File TM Jr, *et al.* Recommendations for treatment of hospital-acquired and ventilator-associated pneumonia: review of recent international guidelines. *Clin Infect Dis* 2010; 51: Suppl. 1, S42–S47.

HERMES Syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases, 7 Respiratory infections
Angoff rating: 50%

Question 242

Which of the following conditions warrants/warrant preventive therapy for patients known to have latent tuberculosis infection?

a. Treatment with tumour necrosis factor-α blocking agents
b. Patients on an organ transplant list
c. Pregnancy
d. Chronic renal failure scheduled for dialysis

Correct answers

a. Treatment with tumour necrosis factor-α blocking agents
b. Patients on an organ transplant list
d. Chronic renal failure scheduled for dialysis

Immunosuppression due to solid-organ transplantation has an odds ratio of 20–74 for developing active disease in patients with latent tuberculosis. The corresponding odds ratios are 1.5–17 in patients on tumour necrosis factor-α treatment and 10–25 in patients with chronic renal failure on dialysis. Therefore, preventive chemotherapy is recommended in these conditions. Latent tuberculosis in uncomplicated pregnancy does not justify immediate treatment, although isoniazid preventive therapy is considered safe.
In low-burden countries, the US Centers for Disease Control and Prevention (CDC) recommend latent tuberculosis screening only for high-risk women: those with known or suspected tuberculosis contacts, injection drug use, HIV or other immunosuppression, being born in a high incidence country, and/or residence in communal institutions. Pregnancy by itself is not considered high risk. In high-burden countries, latent tuberculosis screening is not routinely recommended, though tuberculosis skin test screening is useful in HIV-infected patients for identifying those most likely to benefit from isoniazid preventive therapy.
The World Health Organization (WHO) does not recommend routine use of interferon-γ release assays (IGRAs) for latent tuberculosis screening, and neither WHO nor the CDC have commented on IGRAs in pregnancy.
Active tuberculosis in pregnancy is treated with a standard regimen and supplementation of pyridoxine (50 mg daily); streptomycin and prothionamide should be avoided.

References

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Matha JS, *et al.* Tuberculosis in pregnant and postpartum women: epidemiology, management, and research gaps. *Clin Infect Dis* 2012; 55: 1532–1549.

HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 63%

Question 243

Which of the following statements regarding manifestations and treatment of rheumatoid arthritis (RA) is/are correct?

a. Pleural involvement is more common than parenchymal manifestations.
b. RA-associated interstitial lung disease is more common in females than in males.
c. Patients with anticyclic citrullinated peptide antibodies are at increased risk for the development of extra-articular RA.
d. Adalimumab therapy of RA may cause interstitial pneumonia.

Correct answers

a. Pleural involvement is more common than parenchymal manifestations.
c. Patients with anticyclic citrullinated peptide antibodies are at increased risk for the development of extra-articular RA.
d. Adalimumab therapy of RA may cause interstitial pneumonia.

Pulmonary involvement in RA is common, although pleural involvement is most frequent. Pulmonary involvement includes airway disease, nodules and parenchymal infiltration with a usual interstitial or nonspecific interstitial pneumonia pattern. Rheumatoid nodules are frequently located in the periphery of the right middle or both upper lobes, and range from several millimetres to several centimetres in diameter. Pulmonary involvement is particularly common in males and in patients with high-titre rheumatoid factor and anticyclic citrullinated peptide antibodies. Pulmonary disease may also occur as a side-effect of drugs used to treat RA, such as adalimumab (tumour necrosis factor-α inhibitor) or methotrexate.

References

Anaya J-M, *et al.* Pulmonary involvement in rheumatoid arthritis. *Semin Arthritis Rheum* 1995; 124: 242–254.

Kim EJ, *et al.* Rheumatoid arthritis-associated interstitial lung disease: the relevance of histopathologic and radiographic pattern. *Chest* 2009; 136: 1397–1405.

Komiya K, *et al.* Adalimumab-induced interstitial pneumonia with an improvement of pre-existing rheumatoid arthritis-associated lung involvement. *Intern Med* 2011; 50: 749–751.

HERMES Syllabus link: 13 Respiratory consequences of systemic/extrapulmonary disorders
Angoff rating: 55%

Question 244

A 46-year-old female receives a platelet transfusion because of severe thrombocytopenia after adjuvant chemotherapy for breast cancer. 3 h later, she complains of an acute onset of shortness of breath. S_{pO_2} is 76%, and arterial blood gas analysis reveals P_{aO_2} of 5.99 kPa (45 mmHg), P_{aCO_2} of 3.33 kPa (25 mmHg) and pH 7.50. Her blood pressure is 148/80 mmHg, heart rate is regular at 118 beats per min and temperature is 37.8ºC. The patient is transferred to the intensive care unit and she is placed on NIV (spontaneous timed mode, inspiratory oxygen fraction 0.6, expiratory positive airway pressure (EPAP) 6 cmH_2O, inspiratory positive airway pressure (IPAP) 14 cmH_2O, frequency 15 breaths per min and inspiratory time 1.5 s). The chest radiograph shows bilateral pulmonary infiltrates. Arterial blood gases after 1 h on NIV are P_{aO_2} 8.25 kPa (62 mmHg), P_{aCO_2} 3.72 kPa (28 mmHg) and pH 7.48.
What is the next appropriate step in the management of this patient?

a. Intubate and place the patient on invasive mechanical ventilation
b. Decrease EPAP to 4 cmH_2O
c. Request an echocardiography
d. Increase IPAP to 16 cmH_2O
e. Proceed with current management

Correct answer

e. Proceed with current management

The patient suffers from a transfusion-related lung injury (TRALI) that occurs most often after platelet transfusion (one TRALI per 400 units platelets, one TRALI per 5000 units packed red blood cells). The treatment is largely supportive and consists of ventilator support as well as restrictive fluid replacement. Since the hypoxaemic respiratory failure has improved after 1 h on NIV, there is no need to increase pressure support (IPAP) or to intubate and place the patient on invasive mechanical ventilation. Since TRALI is often transient and improves within hours, antibiotics and a cardiology work-up seem premature at this stage.

Reference

Sihler KC, *et al*. Complications of massive transfusion. *Chest* 2010; 137: 209–220.

HERMES Syllabus link: 18 Respiratory failure
Angoff rating: 52%

Question 245

A 42-year-old woman who abuses intravenous drugs has a cough, blood-streaked sputum and a temperature of 38.8°C. She has lost 13 kg over the past 3 months. Chest radiography shows a right upper lobe infiltrate with cavitation. Three sputum smears are positive for acid-fast bacilli and culture results are pending. Gram staining of her sputum shows numerous leukocytes and scant Gram-positive cocci in clusters. The tuberculin skin test shows 0 mm induration at 48 h. The $CD4^+$ T-cell count is 4.9×10^8 per L. Her serum is positive for antibodies to HIV.
The most likely diagnosis is pulmonary infection due to which one of the following?

a. *Mycobacterium avium-intracellulare*
b. *Mycobacterium kansasii*
c. *Mycobacterium tuberculosis*
d. *Staphylococcus aureus*
e. Mixed anaerobic bacteria

Correct answer

c. *Mycobacterium tuberculosis*

Patients with HIV infection, even in early stages, and *i.v.* drug abusers are at high risk of tuberculosis, both because of drug use alone and because of HIV-related immunosuppression. The duration of symptoms, features of the pulmonary lesion and three positive sputum smears support the hypothesis of a tuberculous infection, rather than *Staphylococcus* or mixed anaerobic bacteria pneumonia. HIV patients could have reduced sensitivity of the tuberculin skin test (TST), primarily attributable to a 'switch off' of TST responsiveness (*i.e.* an all-or-nothing phenomenon). There may be an additional gradual decrease in reaction size with decreasing $CD4^+$ cell count. Nontuberculous mycobacteria (NTM) most often cause disseminated disease in advanced HIV-infection, with *Mycobacterium avium* complex (MAC) and *M. kansasii* accounting for the majority of disseminated NTM cases. HIV-infected patients with disseminated MAC typically present with fever, night sweats, weight loss, fatigue, diarrhoea and abdominal pain, and may have lymphadenopathy, hepatomegaly and/or splenomegaly. The diagnosis of disseminated MAC requires isolation of the organism from blood, lymph node, bone marrow or other sterile sites.

References

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Mandell LA, *et al.* Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *Clin Infect Dis* 2007; 44: Suppl. 2, S27–S72.

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Perlman DC, *et al.* Tuberculosis in drug users. *Clin Infect Dis* 1995; 21: 1253–1264.

HERMES Syllabus link: 8 Mycobacterial diseases, 24 Immunodeficiency disorders
Angoff rating: 63%

Question 246

By which one of the following is pulmonary emphysema most reliably diagnosed?

a. Single-breath *T*LCO
b. Typical angled forced expiratory flow–volume curve
c. Alveolar–arterial oxygen tension difference at maximal exercise
d. The ratio of residual volume to TLC measured by whole-body plethysmography
e. Quantitative HRCT of the lung

Correct answer

e. Quantitative HRCT of the lung

Hayhurst *et al.* (1984) demonstrated a significant correlation between lower attenuation levels in *in vivo* quantitative CT and pathological emphysema assessment in patients scheduled for removal of peripheral bronchial carcinoma. Since then, CT technology has been continuously developed to allow not only quantification of emphysematous destruction but also distinction between different emphysema types (panlobular, centrilobular and paraseptal emphysema) and associated alterations in airways. While single-breath T_{LCO} can be reduced in advanced emphysema, there are other possible causes, like interstitial lung disease and pulmonary oedema, that may also impair diffusion. The typical forced expiratory flow–volume curve with an inflection point is a sign of the bronchial collapse that occurs with advanced COPD. In itself, it is not related to the presence and degree of emphysema and does therefore not allow to diagnose emphysema. As stated above, T_{LCO} can be reduced with advanced emphysema. The alveolar–arterial oxygen tension gradient can be increased in emphysema due to a reduced gas-exchange surface because of capillary damage, which is most pronounced during exercise, when increased cardiac output induces diffusion limitation. Ventilation–perfusion mismatch, right-to-left shunt and diffusion impairment due to interstitial inflammation or fibrosis may also cause gas exchange impairment. Therefore, the alveolar–arterial oxygen tension difference at maximal exercise is not a specific measure to diagnose emphysema. Typically, there is a raised residual volume/TLC ratio in emphysema. However, residual volume measurements can be falsely elevated due to abdominal gas and TLC can be reduced due to concomitant restrictive lung disease. Quantitative HRCT allows a direct assessment of the presence, degree, and distribution of emphysema.

References

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McDonough JE, *et al.* Small-airway obstruction and emphysema in chronic obstructive pulmonary disease. *N Engl J Med* 2011; 365: 1567–1775.

HERMES Syllabus link: 3 Pulmonary function testing, 6 Airway diseases
Angoff rating: 65%

Question 247

A 55-year-old healthy, non-smoking, HIV-negative native European woman with no known exposure to persons with tuberculosis has a tuberculin skin test as part of a routine check-up examination. Induration of 18 mm is noted. Her chest radiograph is normal.
What is the appropriate medication regimen for this person?

a. Isoniazid daily for 12 months
b. Isoniazid and rifampicin daily for 4 months
c. Rifampicin, pyrazinamide and ethambutol daily for 4 months
d. Pyrazinamide and ciprofloxacin daily for 6 months
e. No anti-tuberculous medications

Correct answer

e. No anti-tuberculous medications

The goal of testing for latent tuberculosis infection is to identify individuals who are at increased risk for developing active tuberculosis and would therefore benefit from preventive treatment. This healthy woman has no risk factors for reactivation of tuberculosis and therefore should not have been tested, and thus should not receive treatment regardless of the test result. Moreover, her age indicates that she may have received bacille Calmette–Guérin vaccination in early childhood, which can also explain her tuberculin skin test reaction. None of the proposed regimens is recommended for preventive therapy. Isoniazid prophylaxis is associated with increasing side-effects with age above 35 years.

References

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Targeted tuberculin testing and treatment of latent tuberculosis infection. *Am J Respir Crit Care Med* 2000; 161: Suppl 3, S221–S247.

HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 60%

Question 248

Individuals with which of the following α_1-antitrypsin phenotypes are at highest risk of developing emphysema?

a. PiMS
b. PiMZ
c. PiSS
d. PiSZ
e. PiZZ

Correct answer

e. PiZZ

The Z and S variants of the α_1-antitrypsin (α_1-AT) locus (*SERPINA1*) are associated with α_1-AT deficiency, which is more pronounced with the Z variant. The PiZZ phenotype is associated with profound α_1-AT deficiency (serum α_1-AT levels of 2.5–7.0 μM) and the highest risk of emphysema. All other phenotypes have been associated with reduced serum α_1-AT levels. An increased risk of emphysema has been shown for PiMZ and PiSZ, although less than for PiZZ. There is a paucity of data on the risk of emphysema in PiMS and PiSS but a hypothetical risk (if any) would be expected to be much lower than in the PiZZ population. Smoking, and possibly other external factors, dramatically increase the risk of emphysema in these populations; however, these influences are not changing the ranking of the magnitude of risk.

References

American Thoracic Society, *et al.* American Thoracic Society/European Respiratory Society statement: standards for the diagnosis and management of individuals with alpha-1 antitrypsin deficiency. *Am J Respir Crit Care Med* 2003; 168: 818–900.

Molloy K, *et al.* Clarification of the risk of chronic obstructive pulmonary disease in α1-antitrypsin deficiency PiMZ heterozygotes. *Am J Respir Crit Care Med* 2014; 189: 419–427.

HERMES Syllabus link: 26 Genetic and developmental disorders
Angoff rating: 58%

Question 249

Which statement concerning malignant mesothelioma is correct?

a. Cytology of pleural fluid is the recommended diagnostic test for mesothelioma.
b. Immunohistochemical stains help distinguish it from adenocarcinoma.
c. Fibrosarcomatous histology is more common than epithelial type.
d. Median survival for untreated patients is approximately 2 years.
e. Surgical resection is clearly beneficial in most patients.

Correct answer

b. Immunohistochemical stains help distinguish it from adenocarcinoma.

Cytology of pleural fluid has a sensitivity for mesothelioma that ranges from 33–84%, and there is often confusion between malignant mesothelial cells and metastatic adenocarcinoma cells. European Respiratory Society/European Society of Thoracic Surgeons guidelines advise not to make a diagnosis of mesothelioma based only on pleural fluid cytology because of the high risk of diagnostic error. In case of cytological suspicion or evidence of mesothelioma, pleural biopsy for tissue confirmation should be carried out. Immunohistochemical characteristics may help to corroborate the diagnosis (cytokeratin 5/6, calretinin and WT-1 are positive in mesothelioma; the adenocarcinoma markers CEA, Ber-Ep4 and LeuM1 Bg8 are negative in mesothelioma). Epithelioid subtype is more common (60%). Median survival is under 2 years, 4–13 months for untreated patients. Surgery is indicated only in a small number of patients, usually those with limited epithelioid mesothelioma and good performance status.

References

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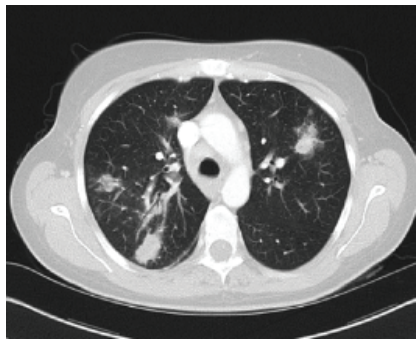
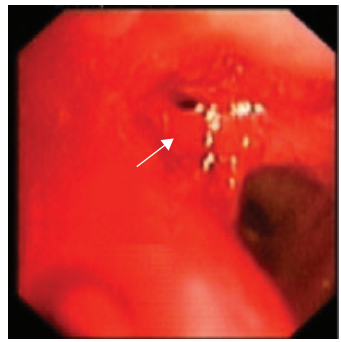
Travis WD, *et al.*, eds. Pathology and Genetics: Tumours of the Lung, Pleura, Thymus and Heart. Lyon, IARC Press, 2004.

HERMES Syllabus link: 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 53%

Question 250

A 37-year-old woman received antibiotic therapy for pneumonia of the right lower lobe 10 weeks ago. Her fever resolved but moderate cough and dyspnoea persisted, and 4 weeks ago, she was treated for otitis media. Now, she is admitted to the hospital due to increasing fatigue, fever and arthralgias. Blood tests reveal a C-reactive protein of 66 $mg \cdot dL^{-1}$ (normal <10 $mg \cdot dL^{-1}$), Hb 87 $g \cdot L^{-1}$ (normal 12.5–15.5 $g \cdot L^{-1}$), leukocyte count 1.33×10^{10} cells per L (normal $4.0–11.0 \times 10^{9}$ cells per L) and thrombocyte count of 8.0×10^{14} per L (normal $<4.0 \times 10^{14}$ per L). A CT image is shown below. Bronchoscopy showed stenosis in the middle lobe bronchus (also shown below, arrow). Bronchoalveolar lavage revealed 27% neutrophils without growth of any microorganisms.





What has to be done next to support the suspected diagnosis?

a. Pulmonary function tests
b. Anti-neutrophil cytoplasmic antibody test
c. Positron emission tomography/CT
d. Scl70 antibody test
e. Surgical lung biopsy

Correct answer

b. Anti-neutrophil cytoplasmic antibody test

Granulomatosis with polyangiitis (GPA) occurs at all ages but is most frequently found in older adults and affects both sexes equally. Patients typically suffer from constitutional symptoms such as fever, migratory arthralgias, malaise, anorexia and weight loss. These prodromal symptoms may be found a long time before specific organ involvement.
Airways or pulmonary parenchyma are often involved in GPA, which can lead to hoarseness, cough, dyspnoea, stridor, wheezing, haemoptysis or pleuritic pain. Most patients with GPA have an abnormal chest radiograph. In the case of alveolar haemorrhage due to pulmonary capillaritis, diffuse ground-glass opacities with or without air bronchogram can be found. The chest radiograph may also show nodules, sometimes with cavitations, lobar or segmental atelectasis due to airway involvement, pleural opacities, and hilar adenopathy. Bronchoscopy may reveal endobronchial involvement, which may manifest as stenosis or endobronchial masses, and transbronchial biopsy of these lesions and/or lung parenchyma may help to provide the diagnosis. Anti-neutrophil cytoplasmic antibodies (ANCAs) are found in 82–93% of patients with GPA, depending on the disease severity. Testing for ANCA should thus be performed in any patient with signs of vasculitis. ANCA was included as a diagnostic criterion in the European Medicines Agency algorithm, thus allowing the diagnosis of GPA without biopsy in an ANCA-positive patient with typical clinic features.

References

Falk RJ, *et al.* Granulomatosis with polyangiitis (Wegener's): an alternative name for Wegener's granulomatosis. *Arthritis Rheum* 2011; 63: 863–864.

Seo P, *et al.* The antineutrophil cytoplasmic antibody-associated vasculitides. *Am J Med* 2004; 117: 39–50.

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Gómez-Puerta JA, *et al.* Antineutrophil cytoplasmic antibody-associated vasculitides and respiratory disease. *Chest* 2009; 136: 1101–1111.

Watts R, *et al.* Development and validation of a consensus methodology for the classification of the ANCA-associated vasculitides and polyarteritis nodosa for epidemiological studies. *Ann Rheum Dis* 2007; 66: 222–227.

Finkielman JD, *et al.* ANCA are detectable in nearly all patients with active severe Wegener's granulomatosis. *Am J Med* 2007; 120: 643–227.

HERMES Syllabus link: 12 Eosinophilic diseases, 13 Respiratory consequences of systemic/extrapulmonary disorders, 14 Pulmonary vascular diseases
Angoff rating: 65%

Question 251

A 69-year-old man with COPD (FEV_1 25% predicted) is admitted to the hospital with a 5-day history of progressive dyspnoea that has made it nearly impossible for him to eat, sleep or walk across the room. He is on long-term oxygen treatment at 2 $L \cdot min^{-1}$. 2 months ago, his arterial blood gases on 2 $L \cdot min^{-1}$ oxygen were P_{aO_2} 8.6 kPa (65 mmHg), P_{aCO_2} 7.4 kPa (56 mmHg) and pH 7.38.

On admission, he has increased cough newly productive of yellow sputum. His sputum volume has decreased from 10–15 mL per day to 5–10 mL per day. His medications include inhaled ipratropium and salbutamol. On physical examination, the patient's pulse rate is 110 beats per min, respiration rate is 36 breaths per min and blood pressure is 146/76 mmHg. He is cachectic, sitting and leaning forward in obvious respiratory distress with pursed-lip breathing. A chest examination reveals palpable contractions of the sternocleidomastoid muscles and diffusely diminished breath sounds with pan-expiratory wheezing. The physical examination is otherwise unremarkable. Arterial blood gases on 2 $L \cdot min^{-1}$ nasal oxygen show a P_{aO_2} of 6.0 kPa (45 mmHg), P_{aCO_2} of 8.8 kPa (66 mmHg) and pH of 7.31.

Which of the following therapies is not likely to benefit this patient?

a. Noninvasive bilevel ventilation
b. Continuing therapy with an inhaled β_2-agonist and ipratropium
c. Increasing nasal oxygen to 4 $L \cdot min^{-1}$
d. Amoxicillin–clavulanic acid
e. Systemic corticosteroids

Correct answer

c. Increasing nasal oxygen to 4 L·min^{-1}

This patient suffers from acute-on-chronic hypercapnic respiratory failure with respiratory acidosis due to exacerbated severe COPD. He is on long-term oxygen treatment at 2 L·min^{-1}. NIV decreases mortality and eases respiratory symptoms in patients with acute COPD exacerbations with hypercapnic respiratory failure. Systemic steroids, dual bronchodilator inhalation and antibiotics are standard treatment for acute COPD exacerbations.
Increasing the supplemental oxygen from 2 to 4 L·min^{-1} may be dangerous because the hypoxic respiratory drive may be damped so that the hypercapnia will increase and the respiratory acidosis will worsen; the patient may lose consciousness due to carbon dioxide narcosis.

Reference

Robinson TD, *et al.* The role of hypoventilation and ventilation–perfusion redistribution in oxygen-induced hypercapnia during acute exacerbations of chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 2000; 161: 1524–1529.

HERMES Syllabus link: 6 Airway diseases, 18 Respiratory failure, 27 Associated specialties
Angoff rating: 68%

Question 252

A 45-year-old HIV-positive male (CD4 cells 2.50×10^8 per L), is referred to you because of a tuberculin skin test with 7-mm induration. He has no specific complaints, has not had contact with tuberculosis patients in the past, and has not had a Bacille Calmette-Guérin (BCG) vaccination. Chest radiography is normal.
Which one of the following is the most appropriate next step?

a. Perform an inteferon-γ release assay (IGRA).
b. No further action is necessary at this time.
c. Repeat the skin test if CD4 cells fall below 2.00×10^8 per L.
d. Prophylactic therapy with isoniazid for 6 months.
e. Prophylactic therapy with isoniazid for 9 months.

Correct answer

e. Prophylactic therapy with isoniazid for 9 months.

In patients with HIV infection, a tuberculin skin test showing an induration of >5 mm should be interpreted as positive. As the patient did not have a BCG vaccination, an IGRA test is not necessary to confirm the tuberculin skin test. If active tuberculosis is ruled out clinically and by chest radiography, prophylactic therapy with isoniazid for 9 months is recommended.

References

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Erkens CG, *et al.* Tuberculosis contact investigation in low prevalence countries: a European consensus. *Eur Respir J* 2010; 36: 925–949.

HERMES Syllabus link: 8 Mycobacterial diseases
Angoff rating: 60%

Question 253

A 41-year-old woman receiving high-dose inhaled corticosteroids is referred with a diagnosis of 'refractory asthma'. In the preceding 6 months, she has been treated in the emergency room for abrupt, acute, short-lived episodes of apparent life-threatening asthma attacks. She has never smoked. Her asthma symptoms began after the death of her brother. While discussing her brother's death, she becomes agitated and suddenly develops an acute attack. Her blood pressure is 140/70 mmHg, pulse rate is 88 beats per min and respiratory rate is 16 breaths per min. On auscultation, wheezes are noted over the anterior portions of her chest. Her arterial blood gases are P_{aO_2} 9.8 kPa (74 mmHg), P_{aCO_2} 4.8 kPa (36 mmHg) and pH 7.42.
Which of the following is most likely to provide a correct diagnosis in this patient?

a. Transnasal laryngoscopy after exercise
b. Flow–volume curves after breathing cold air
c. Flow–volume curves during an attack
d. Methacholine challenge test after an attack
e. Transnasal laryngoscopy after methacholine inhalation

Correct answer

c. Flow–volume curves during an attack

The beginning of symptoms after an emotional stress and development of an attack during a discussion suggest vocal cord dysfunction (VCD), more likely than 'refractory asthma'. Furthermore, on clinical examination, wheezes are only noted over the anterior portion of the chest. VCD is a condition characterised by abnormal adduction of the vocal cords. The clinical presentation of VCD is commonly mistaken for asthma and patients with VCD are frequently misdiagnosed as having poorly controlled or exercise-induced asthma, and their response to standard asthma therapy is generally poor. A psychological origin for VCD has been established and emotional stress is a common precipitant of psychogenic VCD. Flow–volume loop recording during spirometry can reveal the characteristic flattening or truncation of the inspiratory limb that is consistent with variable extrathoracic obstruction, but this finding is generally absent unless patients are acutely symptomatic.
Visualisation of the vocal cords with laryngoscopy during an acute VCD episode is the recommended procedure to confirm diagnosis. The methacoline challenge test is normally negative even if episodes of methacoline-induced vocal cord adduction are reported. In patients suspected of exercise-induced VCD, laryngoscopy is typically performed before and after exercise, although laryngoscopy during exercise testing is reported.

References

Morris MJ, *et al.* Diagnostic criteria for the classification of vocal cord dysfunction. *Chest* 2010; 138: 1213–1223.

Perkins PJ, *et al.* Vocal cord dysfunction induced by methacholine challenge testing. *Chest* 2002; 122: 1988–1993.

Newman KB, *et al.* Clinical features of vocal cord dysfunction. *Am J Respir Crit Care Med* 1995; 152: 1382–1386.

Deckert J, *et al.* Vocal cord dysfunction. *Am Fam Physician* 2010; 81: 156–159.

HERMES syllabus link: 6 Airway diseases
Angoff rating: 54%

Question 254

Which of the following factor(s) would increase the risk for malignancy of a solitary pulmonary nodule?

a. Heavy smoking history
b. Male sex
c. Older age
d. Larger size of the nodule

Correct answers

a. Heavy smoking history
c. Older age
d. Larger size of the nodule

Recent evidence has shown that smoking history, female sex, older age and larger nodule size (together with family history of lung cancer, emphysema, location of the nodule in the upper lobe, part-solid nodule type, lower nodule count, and spiculation) are predictive of malignancy of a solitary pulmonary nodule found on a CT scan. Predictive models have been developed based on these variables.

References

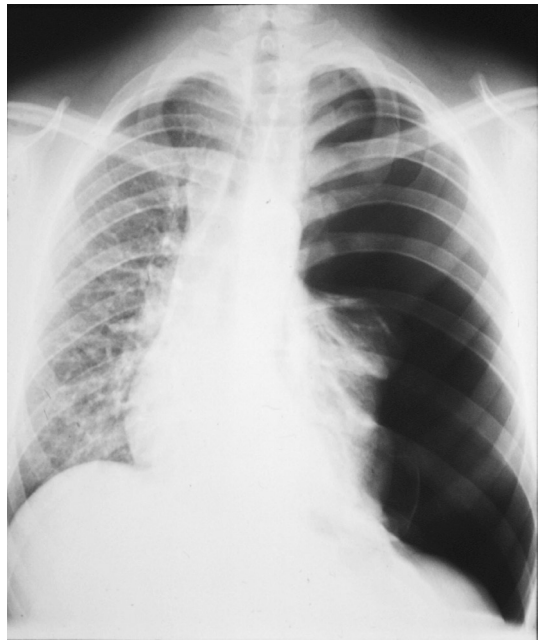
McWilliams A, *et al.* Probability of cancer in pulmonary nodules detected on first screening CT. *N Engl J Med* 2013; 369: 910–919.

Brock University. Lung cancer risk calculator. www.brocku.ca/lung-cancer-risk-calculator

HERMES syllabus link: 5 Treatment modalities and prevention measures, 9 Thoracic tumours, 27 Associated specialties
Angoff rating: 58%

Question 255

A 58-year-old male smoker with a smoking history of 50 pack-years presents to the emergency department after an episode of acute chest pain and shortness of breath. At admission he states that the pain has disappeared and he denies dyspnoea at rest. On physical examination, there is marked reduction of the breath sounds in the left hemithorax. The patient's heart rate is 110 beats per min without any other abnormal clinical findings. His chest radiograph is shown below. Recent lung function tests had revealed an FVC of 70% predicted, an FEV_1 of 45% predicted and a T_{LCO} of 65% predicted.



What is the most appropriate next step in the management of this patient?

a. Observation
b. Administration of high-flow oxygen
c. Simple needle aspiration
d. Insertion of a small-bore (8–14 French) chest tube
e. Insertion of a large-bore (>20 French) chest tube

Correct answer

d. Insertion of a small-bore (8–14 French) chest tube

The chest radiograph shows a left-sided pneumothorax with complete collapse of the lung and a shift of the mediastinal structures to the right. Based on the history and the pulmonary function tests, the patient suffers from COPD. Therefore, he has a secondary spontaneous pneumothorax. The management of a pneumothorax is guided by the clinical presentation, *i.e.* the respiratory and/or cardiovascular compromise and eventual pre-existing lung disease. In the described case of a symptomatic, secondary spontaneous pneumothorax with complete collapse of the left lung, chest tube drainage with a small-bore catheter (size 8–14 French) is recommended. Large-bore chest tubes offer no advantage over smaller-sized tubes in the management of pneumothorax. If the patient was asymptomatic and the pneumothorax was small (defined by a visible rim <2 cm between the lung and the chest wall at the level of the hilum in a conventional chest radiograph), a simple aspiration would be an option. Observation alone is warranted only in cases with an asymptomatic, small, primary spontaneous pneumothorax or in selected cases of asymptomatic large, primary spontaneous pneumothorax. If these patients are discharged, they should receive clear advice to return immediately if symptoms develop. High-flow oxygen is not sufficient in this case. The British Thoracic Society guidelines for management of spontaneous pneumothorax (freely available online) contain a flow chart showing the management of the condition.

Reference

MacDuff A, *et al.* Management of spontaneous pneumothorax: British Thoracic Society pleural disease guideline 2010. *Thorax* 2010; 65: Suppl. 2, ii18–ii31.

HERMES Syllabus link: 20 Pleural diseases
Angoff rating: 68%

Question 256

Which of the following statements about OSAS is false?

a. Upper airway resistance is increased during sleep.
b. Apnoeas, hypopnoeas and respiratory effort-related arousals are found.
c. Sympathetic activity is increased both during sleep and wakefulness.
d. Hypoxaemia attenuates the effects of increased sympathetic tone.
e. OSAS is a risk factor for arterial hypertension.

Correct answer

d. Hypoxaemia attenuates the effects of increased sympathetic tone.

OSAS is a common disorder affecting 5–10% of the adult population. Patients are frequently obese. The disorder is characterised by repeated collapse of the upper airway during sleep leading to hypoxia, resulting in activation of the sympathetic system. Upper airway resistance increases when the airway collapses. Sleep cycles become disturbed and apnoeas, hypopnoeas and arousals in association with increased breathing efforts (respiratory effort-related arousals) are characteristic of the disease. An increase in sympathetic tone is also maintained during wakefulness when the disease progresses. One of the main drivers of the sympathetic tone elevation is the repeated cycles of hypoxaemia. Hypoxaemia by itself is known to enhance, and not to attenuate, sympathetic activity. Elevated sympathetic tone is a major cause of the increase in cardiovascular risk including hypertension.

References

Peppard PE, *et al.* Increased prevalence of sleep-disordered breathing in adults. *Am J Epidemiol* 2013; 177: 1006–1014.

Qaseem A, *et al.* Management of obstructive sleep apnea in adults: a clinical practice guideline from the American College of Physicians. *Ann Intern Med* 2013; 159: 471–483.

Respiratory conditions. *In:* Simonds AK, *et al.*, eds. ERS Handbook of Respiratory Sleep Medicine. Sheffield, European Respiratory Society, 2012; pp. 21–51.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 67%

Question 257

Which of the following statements is/are correct regarding exercise physiology and ventilation?

a. Healthy subjects are able to sustain $\dot{V}_E$ at 70% of their maximum voluntary ventilation (MVV) for ≥15 min.
b. Patients with COPD have reduced ventilatory reserves and increased ventilatory requirements for a given level of exercise.
c. During exercise, dead space to tidal volume ratio decreases in normal subjects, but may increase in patients with COPD.
d. The ventilatory equivalent for carbon dioxide ($\dot{V}_E/\dot{V}_{CO_2}$) is a measure of the efficiency of carbon dioxide elimination, and is usually elevated in patients with COPD.

Correct answers

b. Patients with COPD have reduced ventilatory reserves and increased ventilatory requirements for a given level of exercise.
c. During exercise, dead space to tidal volume ratio decreases in normal subjects, but may increase in patients with COPD.
d. The ventilatory equivalent for carbon dioxide ($\dot{V}_E/\dot{V}_{CO_2}$) is a measure of the efficiency of carbon dioxide elimination, and is usually elevated in patients with COPD.

The ratio of $\dot{V}_E$ divided by the maximum voluntary ventilation ($\dot{V}_{Emax}$/MVV) of 0.70 can be sustained for 15 min in normal individuals, but values above 0.75 are usually not attained even at peak exercise because there is cardiac limitation in untrained individuals. In contrast, ventilatory limitation at peak exercise occurs in obstructive and restrictive lung disease. It is judged to occur when $\dot{V}_{Emax}$/MVV exceeds 85%, particularly if respiratory compensation for metabolic acidosis is not evident.
The ventilatory reserve is usually reduced or absent in COPD at peak exercise. A high $\dot{V}_E$ for a given $\dot{V}_{CO_2}$ is frequently observed in patients with COPD, due to the increased deadspace fraction of tidal volume and a reduced P_{aCO_2} because of arterial hypoxaemia and premature metabolic acidosis.

References

ERS Task Force, *et al.* Recommendations on the use of exercise testing in clinical practice. *Eur Respir J* 2007; 29: 185–209.

Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013.

HERMES Syllabus link: 3 Pulmonary function testing, 4 Other diagnostic procedures
Angoff rating: 48%

Question 258

A 72-year-old man presents because of extreme exertional dyspnoea and fatigue that have progressed over the last 3 years. COPD was diagnosed 3 years ago and oxygen (1 L·min^{-1}) was prescribed for arterial hypoxaemia (P_{aO_2} 7.0 kPa (52 mmHg)). He smoked two packs of cigarettes daily for 20 years but had stopped 30 years ago. On physical examination, he appears ill. His neck veins are distended to the angle of the mandible while sitting up. Cardiac examination reveals a grade 3/6 pansystolic murmur along the left sternal border. Peripheral oedema is also present. The results of pulmonary function and arterial blood gas studies are shown below.

FVC L (% predicted)	4.2 (98)
FEV1 L (% predicted)	3.6 (87)
P_{aO_2} kPa (mmHg)	7.4 (56)
P_{aCO_2} kPa (mmHg)	4.2 (32)
pH	7.41

Chest radiography shows large pulmonary arteries but no other abnormalities. ECG shows Q-waves in II, III and aVF. Echocardiography shows enlargement of the right atrium and right ventricle as well as severe pulmonary hypertension with an estimated systolic pulmonary artery pressure of 78 mmHg. There is no evidence of mitral stenosis or an atrial septal defect. The left ventricle appears normal.
Which of the following is the most appropriate next step?

a. Nebulised bronchodilators
b. Nifedipine titrated to the maximally tolerated dose
c. A sleep study
d. Spiroergometry
e. Right-sided cardiac catheterisation

Correct answer

e. Right-sided cardiac catheterisation

This patient's medical history and symptoms are consistent with acutely decompensated right heart failure. The typical presentation of right-heart failure includes fatigue, peripheral oedema, ascites, abdominal tenderness and oliguria. Myocardial infarction is one of the potential causes, according to the ECG abnormalities pointing towards the involvement of the right ventricle. Spirometric values and the chest radiograph do not suggest a lung disease that would explain the hypoxaemia and pulmonary hypertension.

A sleep study might show sleep apnoea but this sleep-related breathing disorder would not explain the major elevation of pulmonary artery pressure. Although spiroergometry might show impaired exercise performance due to cardiovascular limitation, it would not further clarify the differential diagnosis.

Current evidence shows and the European Society of Cardiology/European Respiratory Society guideline states that right heart catheterisation is required to confirm the diagnosis of pulmonary hypertension, to assess the severity of the haemodynamic impairment and to test the vasoreactivity of the pulmonary circulation.

The diagnosis is not yet established and there is no indication to urgently use any of the listed treatment options.

References

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Global Initiative for Chronic Obstructive Lung Disease. Global strategy for diagnosis, management, and prevention of COPD. www.goldcopd.org/uploads/users/files/GOLD_Report_2015_Apr2.pdf Date last updated: April 2, 2015.

Konstantinides SV, *et al.* 2014 ESC Guidelines on the diagnosis and management of acute pulmonary embolism. *Eur Heart J* 2014; 35: 3033–3080.

HERMES Syllabus link: 14 Pulmonary vascular diseases
Angoff rating: 58%

Question 259

A 61-year-old woman who has severe COPD seeks advice about taking an international flight. Spirometry yields the following values: FVC 2.8 L (78% predicted); FEV_1 0.7 L (29% predicted); arterial blood gases breathing air at sea level are P_{aO_2} 6.50 kPa (49 mmHg), S_{aO_2} 85%, P_{aCO_2} 6.10 kPa (46 mmHg), and pH 7.38. These values are very similar to those of 6 and 12 months ago.
You should advise the patient:

a. Not to travel on a commercial airliner.
b. That she will maintain satisfactory oxygenation during the flight since she will hyperventilate.
c. To use on-board oxygen carried by commercial airlines if shortness of breath develops.
d. To make advance arrangements with the airline for physician-prescribed in-flight oxygen.
e. Additional oxygen is not warranted since commercial airline cabins are pressurised to sea level.

Correct answer

d. To make advance arrangements with the airline for physician-prescribed in-flight oxygen.

Air travel is almost always feasible with appropriate medical support, but this may involve considerable costs. The patient will become more hypoxaemic during the flight as hyperventilation will only partially compensate for the reduced barometric pressure in the cabin. In this woman, oxygen should be recommended at a flow rate of 2–4 L·min^{-1} *via* nasal cannula during the flight even if she is not short of breath as she is already hypoxaemic at sea level. Arrangements for in-flight oxygen have to be made with the airline in advance. A hypoxaemic challenge test with an inspiratory oxygen fraction of 0.15 may aid decision-making on the supplemental oxygen flow rate required, but the relevance of these observations has not been validated by clinical outcomes.

The British Thoracic Society has issued guidelines on managing passengers with stable respiratory disease planning air travel. These recommendations are summarised in the figure and table.

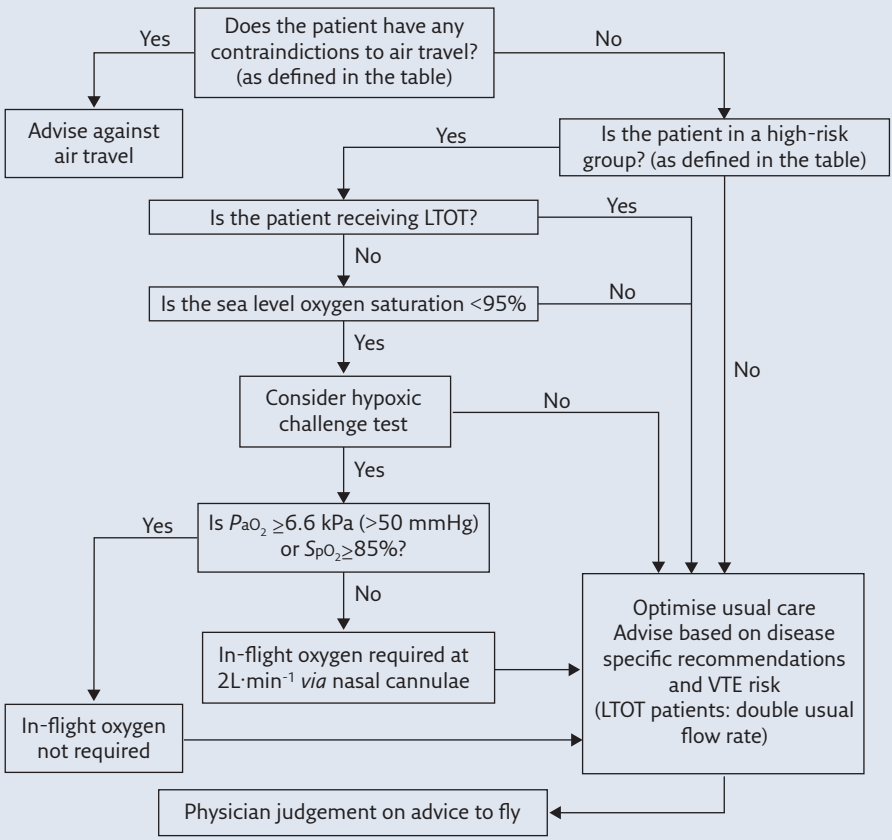


FIGURE Algorithm for managing adult passengers with stable respiratory disease planning air travel. LTOT: long-term oxygen therapy; VTE: venous thromboembolism. Reproduced from Josephs *et al*. (2013) with permission from the publisher.

Table Recommendations for adults

Contraindications to travel
Infectious tuberculosis
Ongoing pneumothorax with persistent air leak
Major haemoptysis
Patients on LTOT whose usual oxygen requirements exceed 4 $L \cdot min^{-1}$ at sea level (because commercial airlines are unable to deliver double this rate, which would be the usual recommendation at altitude)
High-risk patients requiring further evaluation (see figure)
Patients with previous significant respiratory symptoms associated with air travel
Severe COPD (FEV_1 <30% predicted), bullous lung disease, difficult-to-control asthma, cystic fibrosis, or pulmonary tuberculosis
Severe restrictive disease (vital capacity <1 L) including interstitial lung disease, chest wall and respiratory muscle disease, especially if associated with hypoxaemia and/or hypercapnia
Comorbidity with conditions made worse by hypoxaemia (*e.g.* cerebrovascular disease, cardiac disease or pulmonary hypertension)
Recent pneumothorax or within 6 weeks of an acute respiratory illness.
Risk of, or previous history of, venous thromboembolism
Pre-existing requirement for oxygen, CPAP or ventilator support

LTOT: long-term oxygen therapy. Reproduced from Josephs *et al*. (2013) with permission from the publisher.

References

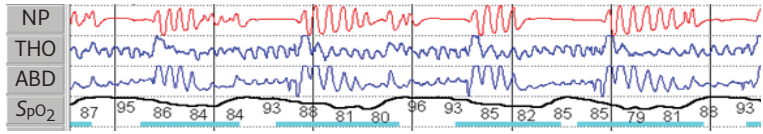
Ahmedzai S, *et al.* Managing passengers with stable respiratory disease planning air travel: British Thoracic Society recommendations. *Thorax* 2011; 66: Suppl. 1,i1–i30.

Josephs LK, *et al.* Managing patients with stable respiratory disease planning air travel: a primary care summary of the British Thoracic Society recommendations. *Prim Care Respir J* 2013; 22: 234–238.

HERMES syllabus link: 5 Treatment modalities and prevention measures, 6 Airway diseases
Angoff rating: 62%

Question 260

Which of the following statements concerning the nocturnal recording below is/are correct?



Vertical lines represent 30-s intervals. NP: nasal pressure swings; THO: rib cage excursions; ABD: abdominal excursions.

a. There is intermittent nasal obstruction.
b. Oxygen saturation during hyperpnoea decreases because of dead-space ventilation.
c. The registered apnoeas are associated with intrathoracic pressure swings.
d. There is Cheyne–Stokes breathing.

Correct answer

c. The registered apnoeas are associated with intrathoracic pressure swings.

This is a typical recording of obstructive apnoeas as evidenced by the intermittent cessation of nasal pressure swings in the presence of paradoxical (asynchronous) rib cage and abdominal excursions. Note that the chest wall excursions are synchronous during hyperpnoea, while they are paradoxical during obstructive apnoeas. Obstructive apnoea causes negative intrathoracic pressure swings as large as –50 to –100 cmH_2O. This has haemodynamic consequences and is one explanation for obstructive apnoeas causing haemodynamic sequelae. Cheyne–Stokes respiration (CSR) is a pattern of waxing and waning of ventilation with intermittent central apnoea/hypopnoeas, *i.e.* chest wall excursions would be in synchrony with abdominal movements. CSR is observed in patients with severe heart failure or stroke. Although the nasal pressure swings intermittently cease, this is not due to nasal obstruction. Changes in nasal resistance occur over much longer time periods, *i.e.* over several minutes to hours.

Reference

De Backer W. Obstructive sleep apnoea/hypopnoea syndrome. *In:* Palange P, *et al.*, eds. ERS Handbook of Respiratory Medicine. 2nd Edn. Sheffield, European Respiratory Society, 2013; pp. 491–497.

HERMES Syllabus link: 22 Sleep and control of breathing disorders
Angoff rating: 50%

Question 261

A 60-year-old homeless male is brought to the emergency department because of severe dyspnoea. The patient states that he can hardly walk anymore because of shortness of breath. This makes it difficult for him to purchase and carry his daily amount of two to three bottles of wine to his shelter. He occasionally smokes if he manages to get some cigarettes. Until he lost his home 10 years ago, he never smoked and only drank occasionally. His medical history is uneventful apart from tonsillectomy in childhood. During transfer from the ambulance stretcher to the hospital bed, he becomes cyanotic and more dyspnoeic as soon he is in upright position. The patient also has jaundice, digital clubbing and spider naevi. Physical examination shows some basilar wheeze. Cardiac auscultation is normal. The liver appears to be small; the spleen is of normal size and there are no signs of ascites or abdominal varices. Hepatojugular reflux is negative. Laboratory tests show moderately elevated liver enzymes (alanine transaminase 312 $U \cdot L^{-1}$) and normal C-reactive protein. Hb concentration is 10.1 $g \cdot dL^{-1}$ with a mean cellular volume of 107 fL. The leukocyte count is normal. P_{aO_2} on room air in sitting position is 8.1 kPa (61 mmHg), P_{aCO_2} is 4.3 kPa (32 mmHg) and pH is 7.42.
What is the most likely diagnosis?

a. COPD
b. Portopulmonary hypertension
c. Weber–Rendu–Osler disease
d. Acute left ventricular failure
e. Hepatopulmonary syndrome

Correct answer

e. Hepatopulmonary syndrome

Hepatopulmonary syndrome (HPS) refers to the triad of hepatic disease, impaired oxygenation and intrapulmonary vascular dilatation. The mechanism of pathogenesis remains controversial but hepatic endothelin and nitric oxide overproduction have been suggested. This leads to pulmonary vascular dilatation, with nonuniform perfusion and increased shunting volume, which worsens in the upright position. Therefore, HPS typically manifests with platypnoea and orthodeoxia. The diagnosis of pulmonary arteriovenous shunts can be made by echocardiography after injection of saline containing air bubbles. The bubbles pass through the enlarged pulmonary blood vessels after four to six cardiac cycles.
This patient exhibits classic HPS. There is evidence of chronic liver failure, but no signs of portal hypertension. Acute left ventricular failure would show a jugular venous distension and a positive hepatojugular reflux, and orthopnoea instead of platypnoea and orthodeoxia. Even though Morbus Osler–Rendu syndrome can have a similar clinical presentation as HPS because of intrapulmonary shunts, there would be oral teleangiectasis instead of the spider naevi and signs of liver failure. COPD is unlikely, considering the limited cigarette smoke exposure and lack of correlation with the other symptoms.

References

Hoeper MM, *et al*. Portopulmonary hypertension and hepatopulmonary syndrome. *Lancet* 2004; 364: 26–27.

Rodriguez-Roisin R, *et al*. Hepatopulmonary syndrome. A liver-induced lung vascular disorder. *N Engl J Med* 2008; 358: 2378–2387.

HERMES Syllabus link: 13 Respiratory consequences of systemic/extrapulmonary disorders
Angoff rating: 50%

Index: the HERMES Syllabus in respiratory medicine

The HERMES Syllabus was under revision at the time this book was written. Therefore, the 27 modules of the draft syllabus are used in the HERMES Syllabus links throughout the book, representing areas of knowledge and skills the respiratory specialist is expected to have. The modules will be further subdivided into more detailed sections. The list of modules is presented below as an index to this book. Please note that these may be subject to change before the new HERMES Syllabus is finalised. Once finished, the new syllabus will be published online at http://hermes.ersnet.org/projects/adult-respiratory-medicine.html

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1	Structure and function of the respiratory system	9, 17, 20, 46, 79, 151, 233
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8	Mycobacterial diseases	1, 7, 37, 58, 70, 78, 83, 105, 166, 199, 202, 212, 232, 242, 245, 247, 252
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10	Interstitial lung disease	6, 12, 13, 21, 27, 32, 51, 60, 63, 91, 118, 142, 145, 146, 154, 160, 165, 167, 173, 193, 200, 224, 234
11	Drug and radiation induced lung diseases	169

12	Eosinophilic diseases	23, 52, 71, 76, 111, 144, 150, 188, 213, 250
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19	Diseases of the chest wall and respiratory muscles including the diaphragm	33, 164, 220
20	Pleural diseases	4, 16, 24, 29, 45, 58, 97, 112, 121, 138, 149, 158, 170, 184, 201, 202, 209, 238, 255
21	Mediastinal diseases excluding tumours	
22	Sleep and control of breathing disorders	3, 10, 15, 25, 36, 43, 44, 61, 74, 79, 90, 92, 95, 104, 117, 122, 128, 139, 143, 168, 185, 194, 203, 204, 205, 217, 223, 225, 237, 256, 260
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24	Immunodeficiency disorders	5, 35, 47, 93, 245
25	Orphan and rare lung diseases	11, 34, 48, 98, 145, 189, 190, 195
26	Genetic and developmental disorders	14, 18, 22, 35, 85, 120, 145, 191, 215, 226, 248
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Blueprint of HERMES examination

In order to have an appropriate representation of topics relevant for respiratory specialists in the HERMES examination, topics listed in the HERMES syllabus are grouped according to two dimensions: diseases and medical actions. Multiple-choice questions (MCQs) are selected from a pool for each examination so that the various topics are represented as listed in the following tables.

HERMES Examination Blueprint Dimension: Diseases	
HERMES Syllabus Module	Approximate representation in HERMES examination
6: Airway diseases 15: Occupational and environmental diseases 16: Environmental diseases	19%
10: Interstitial lung disease 15: Occupational diseases 16: Environmental diseases 25: Orphan and rare lung diseases	10%
7: Respiratory infections 8: Mycobacterial diseases	15%
9: Thoracic tumours	10%
14: Pulmonary vascular diseases	8%
19: Disease of the chest wall and respiratory muscles including the diaphragm 20: Pleural diseases 21: Mediastinal diseases excluding tumours	5%
22: Sleep and control of breathing disorders	10%
12: Eosinophilic diseases 13: Respiratory consequences of systemic/extrapulmonary disorders 15: Occupational diseases	10%
17: Respiratory emergencies 18: Respiratory failure	8%
11: Drug and radiation induced lung diseases 16: Environmental diseases 23: Pregnancy 24: Immunodeficiency disorders 26: Genetic and developmental disorders	5%
Total	**100%**

HERMES Examination Blueprint Dimension: Medical Actions		
General topic	HERMES Syllabus Module	Approximate representation in HERMES examination
Structure and Function of the Respiratory System	1: Structure and function of the respiratory system	10%
Diagnostic Procedures; Differential Diagnosis; Prognosis	2: Signs and symptoms 3: Pulmonary function testing 4: Other diagnostic procedures 6: Airway diseases 7: Respiratory infections 8: Mycobacterial diseases 9: Thoracic tumours 10: Interstitial lung disease 11: Drug and radiation induced lung diseases 12: Eosinophilic diseases 13: Respiratory consequences of systemic/ extrapulmonary disorders 14: Pulmonary vascular diseases 15: Occupational diseases 16: Environmental diseases 17: Respiratory emergencies 18: Respiratory failure 19: Diseases of the chest wall and respiratory muscles including the diaphragm 20: Pleural diseases 21: Mediastinal diseases excluding tumours 22: Sleep and control of breathing disorders 23: Pregnancy 24: Immunodeficiency disorders 25: Orphan and rare lung diseases 26: Genetic and developmental disorders 27: Associated specialties	45%
Treatment Modalities and Prevention Measures	5: Treatment modalities and prevention measures 17: Respiratory emergencies 18: Respiratory failure 22: Sleep and control of breathing disorders 27: Associated specialties	25%
Smoking Cessation; Vaccination and Infection Control; Other Preventative Measures;	5: Treatment modalities and prevention measures 27: Associated specialties	6%
Ethics; Economics of Healthcare		5%
Core Generic Abilities		5%
Other		4%
Total		100%

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Self-Assessment in Respiratory Medicine is an invaluable tool for any practitioner wishing to test and improve their knowledge of adult respiratory medicine. The updated, second edition includes 261 multiple-choice questions covering the full breadth of the specialty, using clinical vignettes that test not only the readers' knowledge but their ability to apply that knowledge in daily practice.

The questions have been compiled and tested by the ERS adult HERMES examination committee specially for this book, making it the perfect revision aid for candidates for the European Diploma, as well as any specialists in respiratory medicine who wish to exercise and improve their skills.

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